Seahorse

TM 55-1520-202-10

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR'S MANUAL

ARMY MODEL

CH-34A

CH-34C

HELICOPTERS

(SIKORSKY)

HEADQUARTERS, DEPARTMENT OF THE ARMY
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This technical manual supersedes TM 55-1520-202-10, 6 February 1962.

TABLE OF CONTENTS

CHAPTER 1
INTRODUCTION

SECTION I
SCOPE

IMPORTANT

In order to obtain complete information and derive maximum benefits from this manual, it is necessary to read this chapter carefully and thoroughly.

1–1. This manual, issued expressly for operators, is an official document for Army Model CH-34A and CH-34C helicopters, serial No. 53-4475 through 53-4554, 54-882 through 54-937, 54-2860 through 54-2914, 54-2995 through 54-3050, 55-4462 through 55-4504, 56-4284 through 56-4342, 57-1684 through 57-1770 and 58-1721. The purpose of this manual is to supply you with the latest information and performance data derived from flight test programs and operational experiences. The study and use of this manual will enable you to perform the assigned missions and duties with maximum efficiency and safety.

1–2. Your ability and experience are recognized. It is not the function of this manual to teach the pilot how to fly; basic flight principles and elementary instructions are not included. The contents of this manual will provide you with a general knowledge of Army Models CH-34A and CH-34C helicopters, their flight characteristics, and specific normal and emergency operating procedures.

1–3. Reports necessary to comply with the Army Safety Program are prescribed in detail in AR 385-40.

1–4. Index. The index lists, in alphabetical order, every important subject under the topic which may be of significance to the operator. This listing is not a repetition of paragraph titles but an extensive listing of subjects which will aid the operator in his use of the manual.

1–5. Appendix I. This appendix consists of a list of references applicable and available to the operator. The list includes official publications directly applicable to the operator's manual. All references called out in the text are reflected in this appendix.

1–6. Appendix II. This appendix consists of a page titled: Appendix II – Maintenance Allocation Chart; and references the Maintenance Allocation Chart contained in TM 55-1520-202-20.

1–7. Appendix III. This appendix consists of a page titled: Appendix III – Basic Checklist; and references DA Form 2408-17, Aircraft Inventory Records Forms.

1–8. Appendix IV. This appendix consists of a page titled: Appendix IV – Operator's Checklist. This checklist contains normal and emergency procedures to be performed by the pilot and copilot. The applicable checklist is not presented in this manual but is printed as a separate publication. A statement to this effect is given in Appendix IV of this manual. Procurement of the applicable checklist manual (TM 55-1520-202-10CL) will be in accordance with instructions contained in AR 310-1 and AR 310-3.

SECTION II
GENERAL

2–1. SCOPE. The contents of this manual are arranged under chapters and sections as indicated in the Table of Contents. A brief description of each chapter is provided in Section I of the applicable chapters.

2–2. Distribution, revision, and authorization for issue are accomplished in accordance with AR 310-1 and AR 310-3.

2–3. Notes, cautions, and warnings shall be used to emphasize important and critical instructions and shall be used for the following conditions

Note

An operating procedure, condition, etc which is essential to highlight.

CAUTION

An operating procedure, practice, etc which, if not strictly observed, will result in damage to or destruction of equipment.

WARNING

An operating procedure, practice, etc which, if not correctly followed, will result in personnel injury or loss of life.

2–4. Reporting of improvements. The direct reporting of errors, omissions, and recommendations for improving this manual by the individual user is authorized and encouraged. DA Form 2028 will be used for reporting these improvements. This form may be completed, using pencil, pen, or typewriter. DA Form 2028 will be completed in triplicate and forwarded by the individual using the manual. The original and one copy will be forwarded directly to Commanding General, Headquarters, U. S. Army Aviation and Surface Materiel Command, P.O. Box 209, Main Office, St. Louis, Missouri, 63166. One information copy will be provided to the individual's immediate supervisor (e.g., officer, noncommissioned officer, supervisor, etc.).

2–5. Department of the Army Record System, AR 750-5, and the Army Equipment Record System and Procedures, TM 38-750, outline the forms and records and their proper completion which are required to be completed by the operator of the CH-34 helicopters.

CHAPTER 2
DESCRIPTION

SECTION I
SCOPE

1–1. GENERAL.

1–2. This chapter provides the operator with information that will familiarize him with the CH-34A and CH-34C helicopters and all the systems, controls, and indicators which contribute to the physical act of flying the helicopter.

1–3. This chapter is not designed to provide instructions on the complete mechanical and electrical workings of the various systems, therefore, each is described only in enough detail to make comprehension of that system sufficiently complete to allow for its safe and efficient operation.

SECTION II
SYSTEMS AND CONTROLS DESCRIPTION

2–1. THE HELICOPTER.

2–2. Models CH-34A and CH-34C, helicopters (figure 2–1) by Sikorsky Aircraft, Division of United Aircraft Corporation, Stratford, Connecticut. They are designed for transportation of cargo and personnel (including aero-medical evacuation). The two models are identical except for the installation of automatic stabilization equipment (ASE) in Model CH-34C. Configuration is single engine, four-bladed main lifting rotor, four-bladed anti-torque tail rotor, and conventional fixed landing gear. The fuselage is of all-metal semimonocque construction and is comprised of three sections; the forward fuselage section, the tail cone or aft fuselage section, and the tail pylon. The forward fuselage section consists of the engine compartment, pilots' compartment, main transmission compartment, cabin, electronics compartment, and fuel tanks. The engine compartment is located in the nose of the forward fuselage section. The engine is installed with the drive shaft pointed aft and upward. A hydro-mechanical clutch is installed at the end of the engine shaft. Large clamshell-type engine access doors, which form the nose of the fuselage, permit access to the engine. Above and aft of the engine compartment is the pilots' compartment which may be entered from the outside of the helicopter or from the cabin. Dual controls are installed in the pilots' compartment. Directly aft of the pilots' compartment is the transmission compartment housing the main gear box. The main transmission drive shaft extends forward and downward from the main gear box and is connected to the hydro-mechanical clutch. The main rotor drive shaft extends vertically from the top of the main gear box. The main rotor hub assembly, to which the four main rotor blades are attached, is splined to the top of the drive shaft. Shafting extends aft from the main gear box lower housing to drive the tail rotor. Directly aft of the engine compartment and below the pilots' compartment and transmission compartment is the cabin. The cabin is 13 feet 5 inches long, 5 feet wide, and 5 feet 10 inches high. Entrance to the cabin is through a sliding door on the right side of the fuselage. Provisions are made for the installation of 12 or 18-man troop seats or eight pole-type litters. (Refer to paragraphs 4–31 and 4–35, Chapter 6.) Three multi-cell fuel tanks are installed below the cabin floor in the bottom structure of the fuselage. Aft of the cabin is the electronics compartment containing radio, electrical, and electronics equipment. The electronics compartment is accessible through an opening in the aft bulkhead of the cabin. The tail cone extends aft from the electronics compartment. The only equipment installed in the tail cone is the cabin heater unit and the gyrocompass transmitter. The tail pylon is attached to the rear of the tail cone. A ground adjustable horizontal stabilizer is installed on the pylon. The intermediate gear box is installed in the lower portion of the pylon and a shaft extends upward to the tail gear box at the top of the pylon. The four-bladed tail rotor is splined to the tail rotor gear box. For storing, the four main rotor blades may be folded parallel to the fuselage and the pylon folded forward along the left side of the tail cone. Main components of the helicopter are shown in figures 2–2 and 2–3.

2–3. DIMENSIONS.

Length:
- Maximum (Main blades extended) ....65 feet 10 inches
- Minimum (Main blades and pylon folded) ....37 feet 0 inches

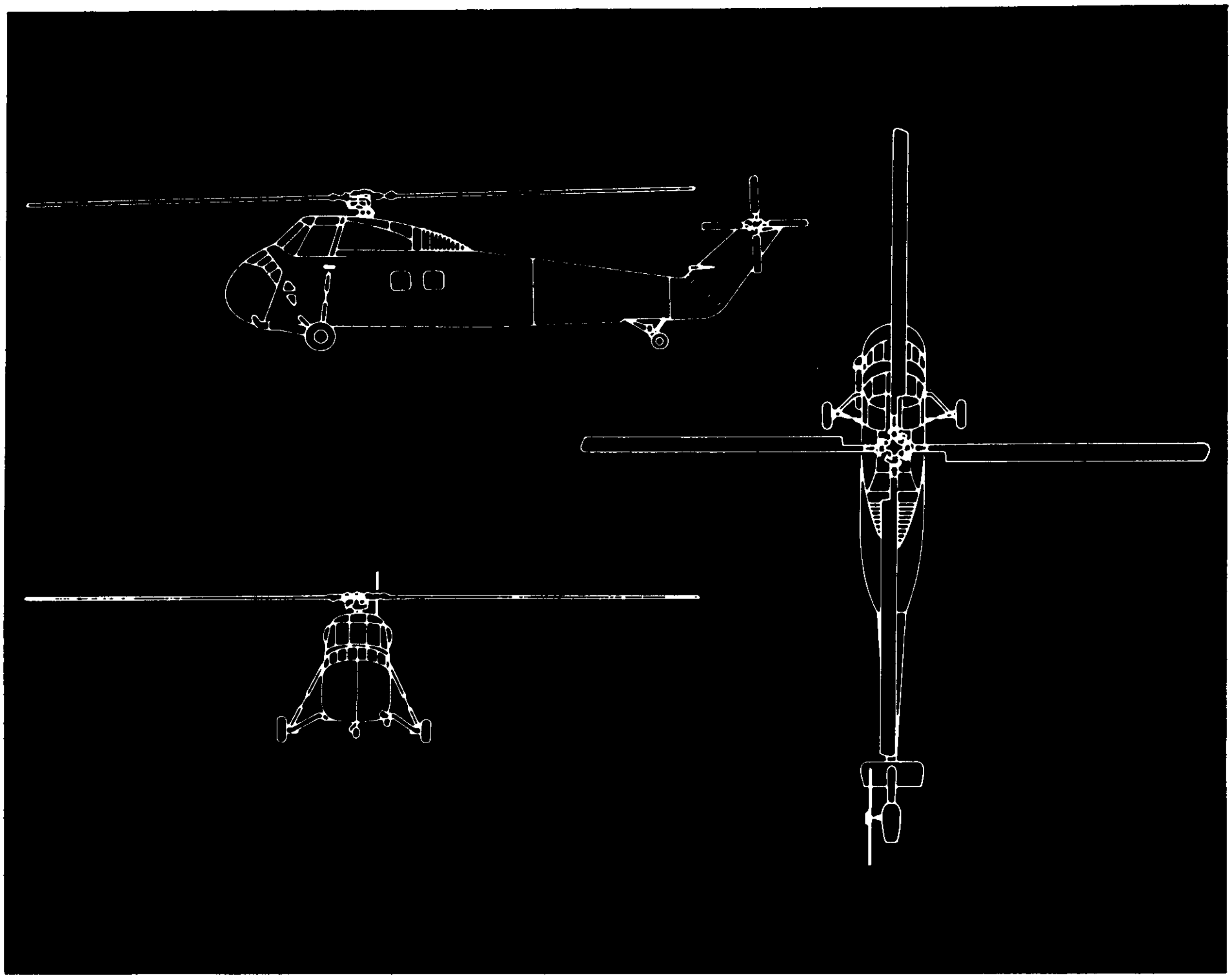
Height:
- Maximum – to top of tail rotor (blade vertical) ....15 feet 11 inches
- Minimum – pylon folded (tail rotor position 45°) ....14 feet 10 inches

Width:
- Maximum – main blades extended ....56 feet 0 inches
- Minimum – main blades and pylon folded ....13 feet 0 inches

Main rotor diameter ....56 feet 0 inches
Tail rotor diameter ....9 feet 6 inches
Minimum main rotor ground clearance (static tip clearance – forward sector) 9 feet 2 inches
- Minimum tail rotor ground clearance ....6 feet 6 inches

Main landing gear tread ......12 feet 0 inches

2–4. GROSS WEIGHT ....11,500 to 13,600 pounds. (For detailed weight information, refer to Chapter 7.)



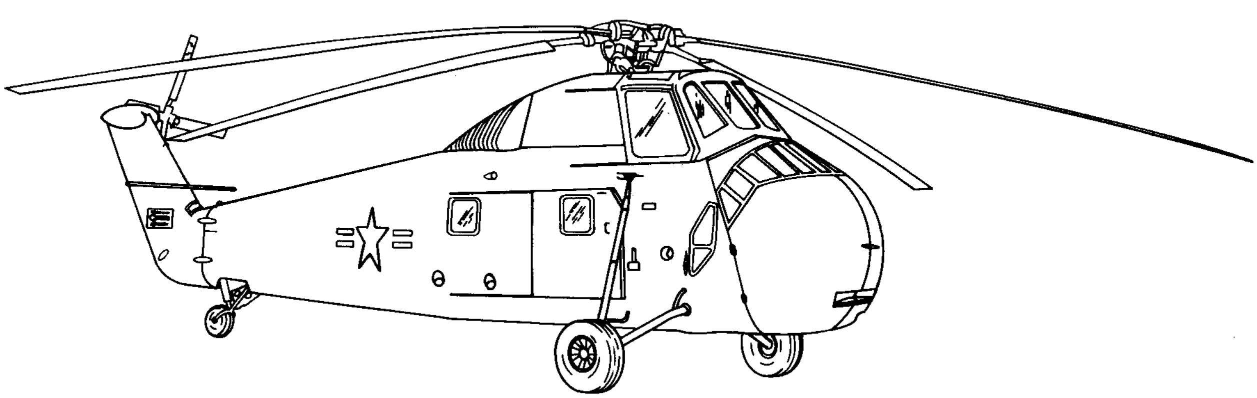


Figure 2–1. Model CH-34A and CH-34C Helicopters

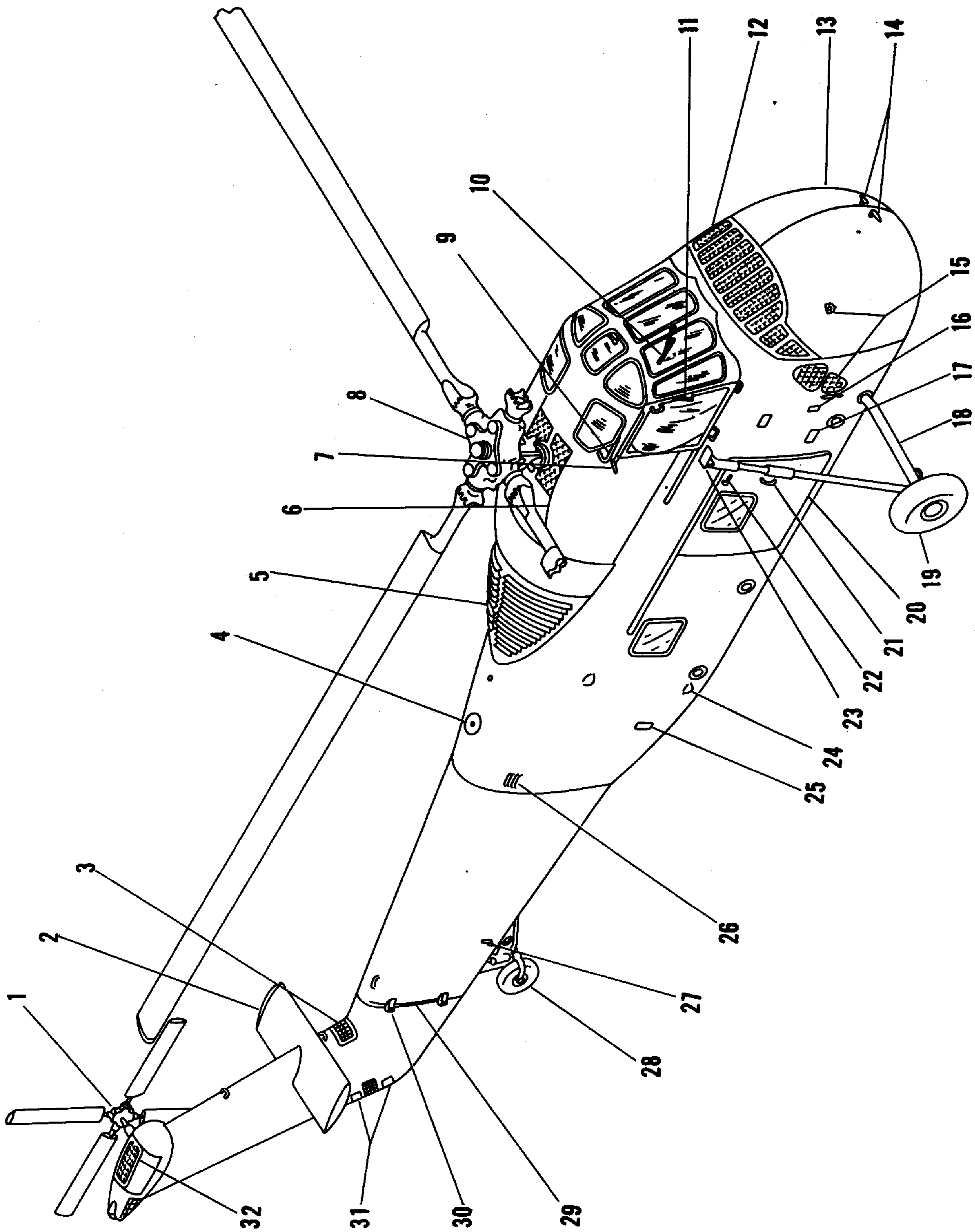


Figure 2–2. General Arrangement — Right-Hand Side (Typical) (Sheet 1 of 2)

1. Tail Rotor
2. Stabilizer
3. Intermediate Gear Box Cooling Air Inlet
4. Static Port
5. Main Gear Box Cooling Air Outlet
6. Service Platform
7. Service Platform Lock Handle
8. Main Rotor
9. Pitot Tube
10. Windshield Wiper
11. Pilots' Compartment Window Latch
12. Engine Air Intake Screens
13. Engine Access Doors
14. Engine Access Door Handles
15. Engine Access Door Open Lock Strut and Socket
16. External Power Receptacle (Helicopters Serial No. 56-4313 and Subsequent and Model CH-34C)
17. Pilots' Compartment Access Foot Wells
18. Main Landing Gear
19. Mooring Fitting – Lower Forward
20. Cabin Door
21. Cabin Door Handle
22. Cabin Door Emergency Release Handle
23. Step and Mooring Fitting – Upper Forward
24. Cabin Air Vent
25. External Power Receptacle (Model CH-34A No. Prior to 56-4313)
26. Electronics Compartment Vents
27. Mooring Fitting – Aft
28. Tail Wheel
29. Pylon Lock
30. Pylon Lock Pin Position Indicator
31. Pylon Fold Hand Grips
32. Tail Rotor Gear Box Cooling Air Inlet

Figure 2–2. General Arrangement – Right-Hand Side (Typical) (Sheet 2 of 2)

2–5. ENGINE. (See figure 2–3.)

2–6. GENERAL.

2–7. The Wright R-1820-84A engine (29) is a conventional, air-cooled, nine-cylinder, single-row, radial engine with special provisions for installation with the drive shaft inclined upwards. The engine is installed in the nose of the helicopter with the drive shaft extending aft and inclined upward at an angle of 35 degrees. Large clamshell-type engine access doors (13, figure 2–2), which form the nose of the helicopter, provide access to the engine for maintenance purposes. A fan, to provide air for the engine cooling and induction systems, and a hydro-mechanical clutch, to connect or disconnect the engine and transmission system, are attached to the engine drive shaft.

2–8. THROTTLE. (See figure 2–7.)

2–9. At the left side of each seat in the pilots' compartment is a collective pitch lever which controls the collective pitch of the main rotor blades. On the forward or outer end of the collective pitch lever is a rotatable grip similar to that on motorcycles. This rotatable grip is the throttle (3). The throttle is fully closed when the grip is turned to its limit to the right and is opened when the grip is turned toward the left. Rotation of the grip from fully closed to fully opened is 110 degrees. The throttle and collective pitch lever are partially synchronized by mechanical linkage. For a complete description and effect of this synchronization, refer to paragraph 3–32, Chapter 8.

2–10. THROTTLE FRICTION LOCK NUT. (See figure 2–7.) A throttle friction lock nut (2) at the base of the throttle grip is located on the pilot's collective pitch lever. Twisting the knurled nut controls the force necessary to turn the throttle. Friction applied by this nut will also prevent the throttle grip from creeping. A decal, on the collective pitch lever forward of the friction nut, is marked THROTTLE LOCK – INCREASE FRICTION and has an arrow indicating the direction to twist the nut to increase friction.

2–11. CARBURETOR.

2–12. A double-barrel, downdraft, injection-type carburetor is mounted on the engine accessory section at the entrance to the supercharger inlet.

2–13. MIXTURE LEVER. (See figure 2–8.) The mixture lever (2) is located on the right side of the engine quadrant mounted on the engine control console aft of the radio panels. The quadrant marked MIXTURE, has three marked positions, RICH, NORMAL, and IDLE CUT-OFF. The RICH position is used for starting, ground operation, takeoff, landing, and all operation above military rated power. The NORMAL position is used for cruising with power settings up to and including military rated power. The IDLE CUT-OFF position is used to shut off fuel flow at the carburetor. To permit proper metering of the fuel at the carburetor, the mixture lever must be placed in either the RICH or NORMAL position. Detents, which can be felt through the mixture lever, identify the correct RICH or NORMAL positions. A trigger, located on the lever below the knob, must be depressed to release a ratchet before the lever can be moved to the IDLE CUT-OFF position. The mixture lever is connected to the mixture control arm of the carburetor by control rods and a flexible cable.

2–14. CARBURETOR AIR LEVER. (See figure 2–8.) The carburetor air lever (3) is located on the left side of the engine quadrant. The engine quadrant, located on the engine control console is marked CARB AIR and has two marked positions, DIRECT and ALTERNATE. The carburetor air

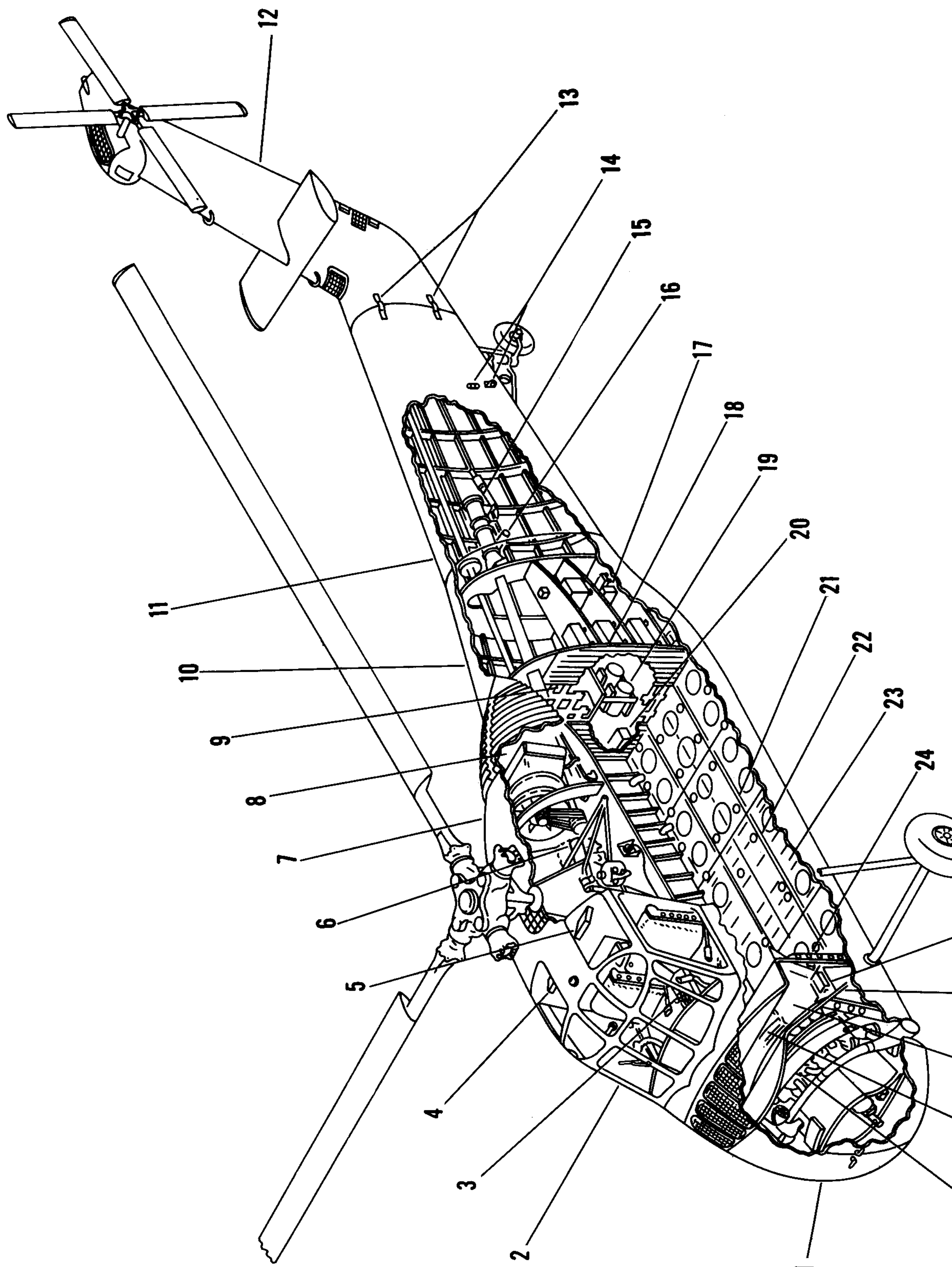


Figure 2–3. General Arrangement – Left-Hand Side (Typical) (Sheet 1 of 2)

1. Engine Compartment
2. Pilots' Compartment
3. Control Console
4. Map Case
5. Data Case
6. Generator
7. Transmission Compartment
8. Main Gear Box Oil Cooler
9. Personnel Barrier
10. Electronics Compartment
11. Tail Cone
12. Pylon
13. Pylon Hinges
14. Pylon Folded Locking Strut
15. Heater
16. Heater Exhaust
17. Radio Equipment
18. Aft Cabin Bulkhead
19. Inverters } (Model CH-34A Serial No. Prior to 56-4313)
20. Battery } (Model CH-34A Serial No. Prior to 56-4313)
21. Cargo Tie-Down Rings
22. Cargo Skids
23. Fuel Tank Compartment
24. Pilots' Compartment Ladder
25. Inverters } (Helicopters Serial No. 56-4313 and Subsequent and Model CH-34C)
26. Battery } (Helicopters Serial No. 56-4313 and Subsequent and Model CH-34C)
27. Clutch and Fan Compartment
28. Firewall
29. Engine

Figure 2-3. General Arrangement – Left-Hand Side (Typical) (Sheet 2 of 2)

lever is used to apply heated air to the carburetor for the prevention of carburetor ice. The lever is connected by control rods and flexible cable to two dampers, one in the direct air duct to the carburetor and the second in the alternate air duct located inside of the engine compartment above the engine exhaust manifold. When the carburetor air lever is in the DIRECT position, air is drawn through the air intake screens and is forced by the fan through the direct air intake duct to the carburetor. As the lever is moved toward the ALTERNATE position, the damper in the direct air duct gradually closes and the damper in the alternate air duct gradually opens, permitting a mixture of cold and heated air to enter the carburetor. The lever may be adjusted to any intermediate position between DIRECT and ALTERNATE to regulate carburetor air temperature. A trigger, located on the lever below the knob, must be depressed before the carburetor air lever can be moved.

2-15. ENGINE COOLING AND AIR INDUCTION SYSTEM. (See figure 2-9.)

2-16. Air for the engine cooling and air induction system enters through engine air intake screens (12, figure 2-2) on the upper and side cowl panels of the nose section of the fuselage, and is forced forward into the engine section by the fan attached to the engine drive shaft. Induction system air is forced by the fan into a duct which extends over the top of the engine to the carburetor. Alternate air for carburetor heat is drawn from within the engine compartment. Cooling system air is forced by the fan into the engine compartment. After passing through a cowling and baffles surrounding the cylinders, the air is exhausted through an opening at the bottom of the engine compartment. A second air duct extends downward to supply cooling air to a thermostatically controlled oil cooler which is located at the aft end of the engine cooling air exhaust outlet.

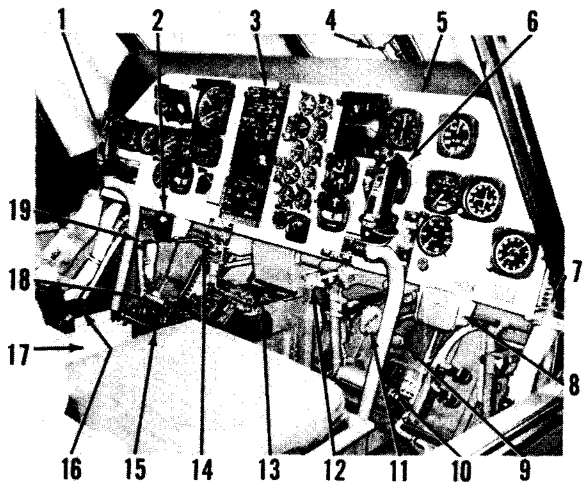
2-17. IGNITION SYSTEM.

2-18. Ignition is furnished by a dual magneto located on the accessory section of the engine. Auxiliary high voltage for starting is provided by an induction vibrator. After the engine is started, voltage is developed by the dual magneto. The right magneto provides ignition for the front spark plugs and the left magneto provides ignition for the rear spark plugs. The induction vibrator is energized only when the ignition switch is placed in the BOTH or R position and the starter button is depressed. Releasing the starter button breaks the circuit to the induction vibrator.

2-19. IGNITION SWITCH. (See figure 2-16.) A dual ignition switch, marked IGNITION, is located on the lower part of the main switch panel. Marked positions for the switch are BOTH, L (left), R (right), and OFF. An induction vibrator, which operates on direct current from the primary bus, supplies electrical current to the right magneto for starting the engine. The circuit to the induction vibrator is energized only when the starter button is depressed and the ignition switch is in the BOTH or R position. After the engine is operating, spark is developed by the dual magneto distributor which is driven by the engine.

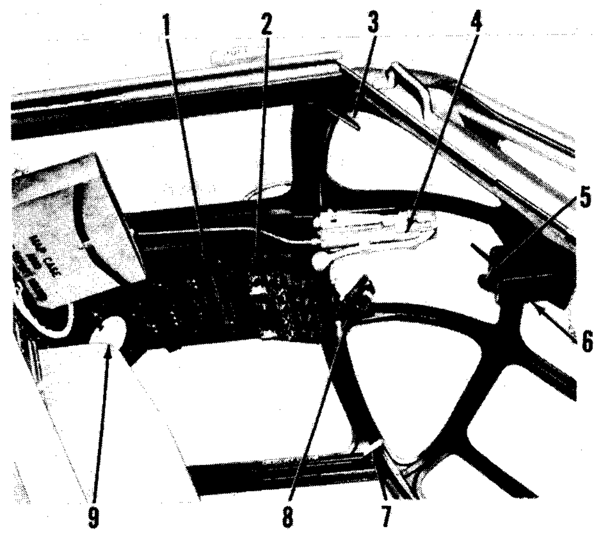
2-20. PRIMER SYSTEM.

2-21. The engine primer system supplies fuel to the engine for the initial starting of the engine. An electrically operated primer valve, which is part of the carburetor and is actuated by an engine primer button, permits fuel to enter the engine through primer injection points at the base of the carburetor. The primer system operates on direct current from the primary bus and is protected by a circuit breaker, marked STARTER, ENG PRM, and OIL DIL, located on the overhead circuit breaker and fuse panel (figure 2-21.)



1. Copilot's Cyclic Stick
2. Ash Tray
3. Main Switch Panel
4. Windshield Wiper Motor
5. Instrument Panel
6. Pilot's Cyclic Stick
7. Windshield Defogging Duct
8. Ash Tray
9. Brake Pedals
10. Pilot's Tail Rotor Pedals
11. Pilot's Tail Rotor Pedal Adjustment Knob
12. Tail Wheel Lock Handle
13. Radio Control Console
14. Parking Brake Handle
15. Automatic Stabilization Equipment Control Panel (Model CH-34C)
16. Engine Quadrant
17. Pilot's Shoulder Harness Inertia Reel Lock Lever
18. Copilot's Tail Rotor Pedals
19. Copilot's Tail Rotor Pedal Adjustment Knob

Figure 2-4. Pilots' Compartment - Right-Hand Side (Typical)



1. Overhead Circuit Breaker and Fuse Panel
2. Overhead Switch Panel
3. Emergency Release Handle for Pilot's Sliding Window
4. Rotor Brake Lever and Hydraulic Cylinder
5. Free-Air Temperature Gage
6. Standby Compass
7. Emergency Release Handle for Copilot's Sliding Window
8. Spotlight
9. Dome Light

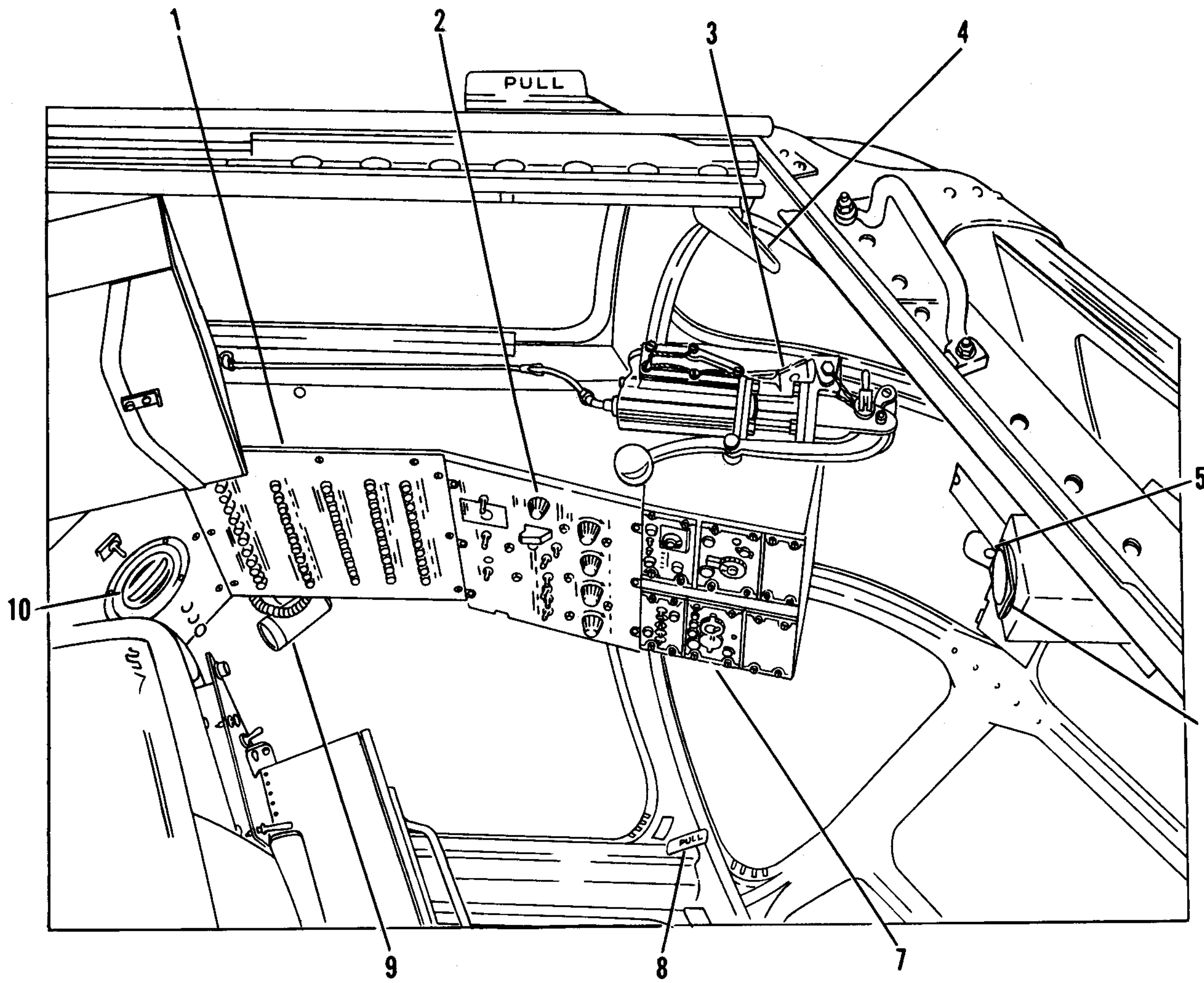
Figure 2-5. Pilots' Compartment - Overhead (Typical) (Helicopters Serial No. Prior to 57-1742)

2-22. ENGINE PRIMER BUTTON. (See figure 2-8.) A spring-loaded engine primer button, (4) is located on the engine control console next to the engine quadrant. The primer button is marked ENG PRI. When the button is depressed, a solenoid valve on the carburetor allows fuel under pressure to flow into the impeller section through a nozzle at the base of the carburetor. When finger pressure is released, priming stops. Fuel pressure for priming is supplied by the fuel booster pump.

2-23. STARTER SYSTEM.

2-24. A 24-volt, direct-cranking starter is located in the accessory section of the engine. The starter and induction vibrator are energized through the starter relay when the starter button is depressed. The starter jaw engages with the engine jaw to turn the engine. When the engine starts, the engine jaw overrides the starter jaw and disengagement is automatic. After the engine has started and the starter button is released, the circuit to the induction vibrator is broken and ignition system voltage is provided by the engine-driven magneto distributor. The starter system is protected by a circuit breaker, marked STARTER, ENG PRM, and OIL DIL, located on the overhead circuit breaker and fuse panel (figure 2-21). The starter system operates on direct current from the primary bus.

2-25. STARTER BUTTON. (See figure 2-7.) The starter button (5) is located under the landing light control box on the forward end of the pilot's collective pitch lever. The starter button is marked START and is pressed in to engage the direct-cranking-type starter. The starter button also energizes the induction vibrator when the ignition switch is placed in the BOTH or R position. When the starter button is released, the circuit to the vibrator is broken and spark is produced by the dual magneto distributor which is driven by the engine. A throttle limit switch is installed on some throttles which prevents the starter from being energized unless the collective pitch lever is in the low pitch position and the throttle grip is



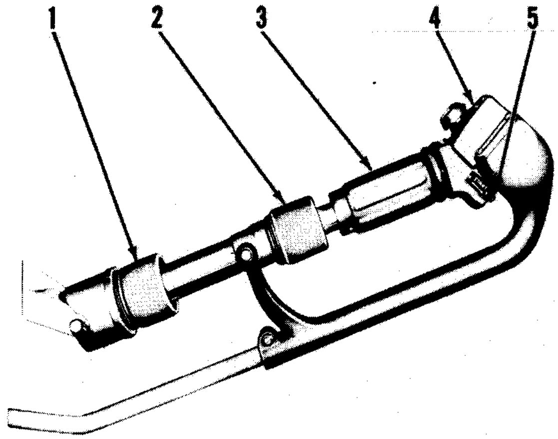
1. Overhead Circuit Breaker and Fuse Panel
2. Overhead Switch Panel
3. Rotor Brake Lever and Hydraulic Cylinder
4. Emergency Release Handle for Pilot's Sliding Window
5. Free-Air Temperature Gage
6. Standby Compass
7. Overhead Radio Control Panel
8. Emergency Release Handle for Copilot's Sliding Window
9. Spotlight
10. Dome Light

Figure 2–6. Pilots' Compartment – Overhead (Typical) (Model CH-34C, Serial 57-1742 and Subsequent)

closed or slightly open. The starter operates on direct current from the primary bus.

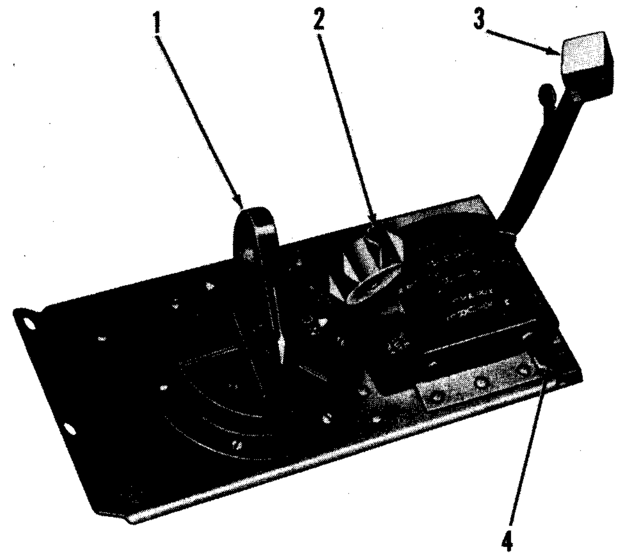
2–26. ENGINE INSTRUMENTS. (See figures 2–10 and 2–11.)

2–27. DUAL TACHOMETER. Two electrically operated dual tachometers (2 and 17, figure 2–10, and 20 and 43, figure 2–11) are mounted on the instrument panel. One is mounted in front of the pilot and the other in front of the copilot. The tachometers operate on electrical power supplied by two tachometer-generators. One is driven by the engine and the other by the main gear box. The engine and rotor tachometer-generators are synchronized at the ratio of approximately 11.3 to 1.0 (ratio of engine speed to main rotor speed) to line up the pointers when the clutch is engaged in direct mechanical drive. Each dual tachometer has two scales and two pointers. The long pointer and the outer scale indicate engine rpm in hundreds. The short pointer indicates rotor speed, though the rpm cannot be read directly from the inner scale as the engine scale and the rotor scale are not graduated in the same ratio as engine speed to rotor speed. When it is necessary to check rotor speed, such as during clutch engagement or auto-



1. Collective Pitch Lever Lock Nut
2. Throttle Friction Lock Nut
3. Throttle
4. Landing Light Control Box
5. Starter Button

Figure 2–7. Pilot's Collective Pitch Lever



1. Fuel Flow Selector Valve Handle
2. Mixture Lever
3. Carburetor Air Lever
4. Engine Primer Button

Figure 2–8. Engine Control Console

rotation, use equivalent engine speeds (engine rpm/ 11.293) or the range markings of the inner scale.

2–28. MANIFOLD PRESSURE GAGE AND PURGE BUTTON. Two manifold pressure gages (19 and 35, figure 2–10 and 23 and 42, figure 2–11) are mounted on the instrument panel. One is mounted in front of the pilot and one in front of the co-pilot. The gages are connected to the intake manifold and indicate manifold pressure in inches of mercury. A button (20, figure 2–10 and 24, figure 2–11), marked MANIFOLD PRESSURE, PUSH TO DRAIN, is located below the pilot's gage. Pressing the button opens a valve which permits air at atmospheric pressure to enter the line connecting the gage to the intake manifold. To purge the line, the button is depressed for several seconds while the engine is operating at a manifold pressure several inches below field barometric pressure. Air at atmospheric pressure will enter the valve and flow toward the intake manifold, purging the line of moisture and foreign matter. If the purge is depressed while the engine is running at or above field barometric pressure, foreign matter may be blown into the gage. When the button is released, spring action closes the purge valve.

2–29. CYLINDER HEAD TEMPERATURE GAGE. A cylinder head temperature gage (11, figure 2–10 and 14, figure 2–11), located on the instrument panel, is wired to a bayonet-type resistance bulb installed in the No. 7 cylinder. The bulb creates a resistance in proportion to the temperature in the cylinder which varies the current flowing to the gage. The gage is calibrated to indicate the current flow in degrees centigrade. The system operates on direct current from the primary bus.

2–30. ENGINE OIL TEMPERATURE GAGE. The engine oil temperature gage (10, figure 2–10 and 13, figure 2–11) is located on the center of the instrument panel. The gage indicates engine oil temperature in degrees centigrade. A temperature bulb connected at the oil inlet port actuates the gage through direct current from the primary bus.

2–31. ENGINE OIL PRESSURE GAGE. The engine oil pressure gage (9, figure 2–10 and 12, figure 2–11) is located in the center section of the instrument panel. The gage indicates oil pressure in psi at the oil inlet to the engine. The engine oil pressure gage operates on current from the 26-volt alternating current bus.

2–32. CARBURETOR AIR TEMPERATURE GAGE. A carburetor air temperature gage (27, figure 2–10 and 31, figure 2–11) is located on the instrument panel. The gage indicates the temperature, in degrees centigrade, of the air in the induction system before entering the carburetor. The gage operates on direct current from the primary bus. The temperature of the induction air may be regulated by the carburetor air level.

2–33. FUEL PRESSURE GAGE. The fuel pressure gage (7, figure 2–10 and 11, figure 2–11), located in the upper center of the instrument panel, indicates engine fuel pressure in psi. The gage is

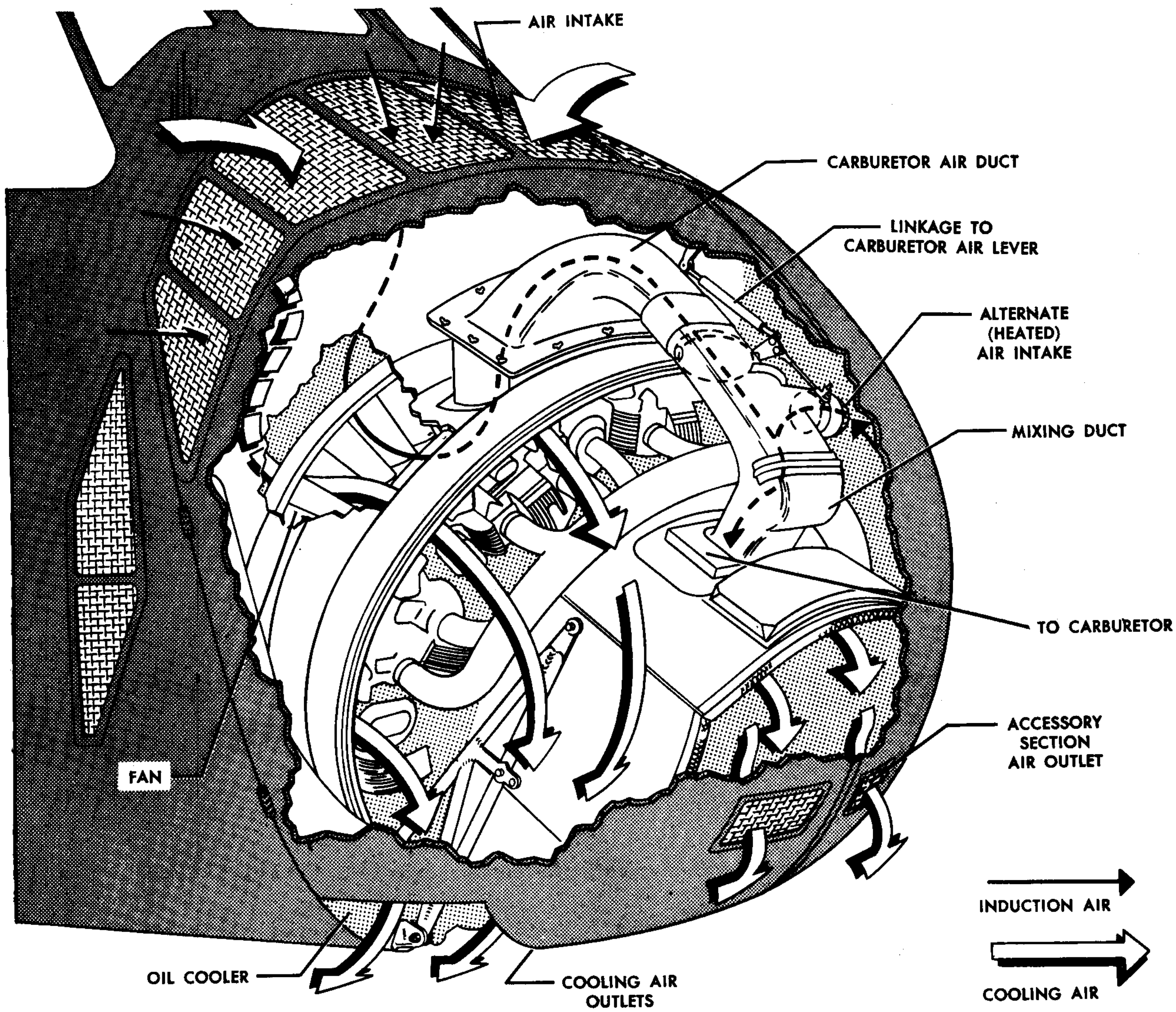


Figure 2–9. Engine Cooling and Air Induction System

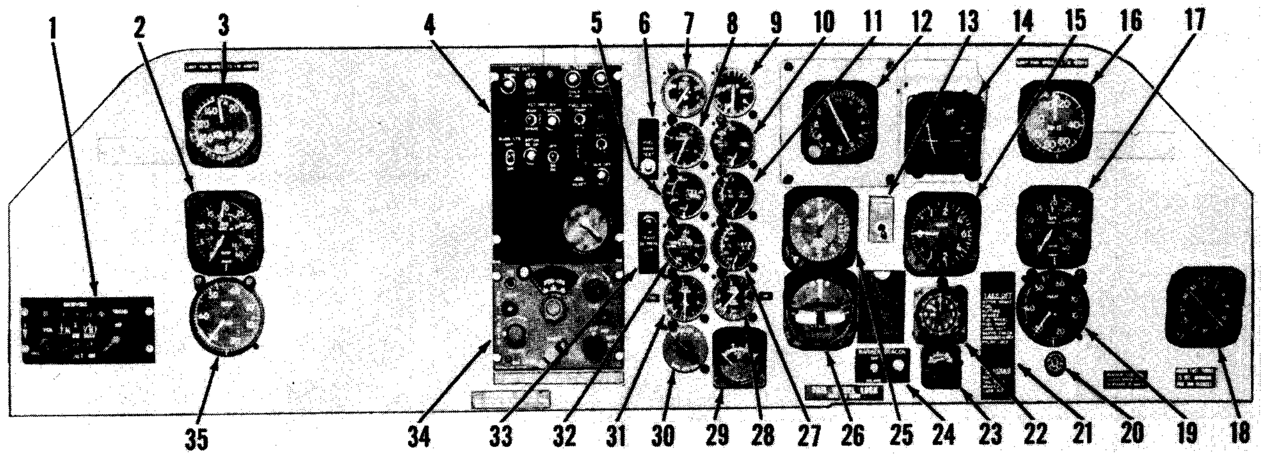
connected electrically to a pressure transmitter, located on the right-hand side of the engine compartment forward of the canted bulkhead. The gage operates on current from the 26-volt alternating current bus.

2–34. TRANSMISSION SYSTEM. (See figure 2–12.)

2–35. The purpose of the transmission system is to transmit engine power and to reduce engine rpm for operating the main and tail rotors. A hydro-mechanical clutch isolates the engine from the transmission system and permits the engine to be started, stopped, and operated without driving the transmission. In event of an engine failure, a freewheeling unit in the clutch will permit the rotors to autorotate free of engine drag. Engine torque is transmitted to the main rotor at a reduced rpm by the main gear box. The main gear box also transmits engine torque through a tail drive shaft to the intermediate gear box which transmits the torque through a drive shaft to the tail rotor gear box. The shafts extending from the main gear box to the intermediate gear box and tail rotor gear box are equipped with rubber couplings to reduce shock loads. A rotor brake is located on the tail drive shaft just aft of the main gear box. An automatic shaft disconnect which permits folding of the pylon, is located forward of the intermediate gear box in line with the hinge points. Main components of the transmission systems are shown in figure 2–12.

2–36. HYDRO-MECHANICAL CLUTCH.

2–37. The hydro-mechanical clutch is located between the engine and the main drive shaft. The lower end of the clutch is splined to the en-



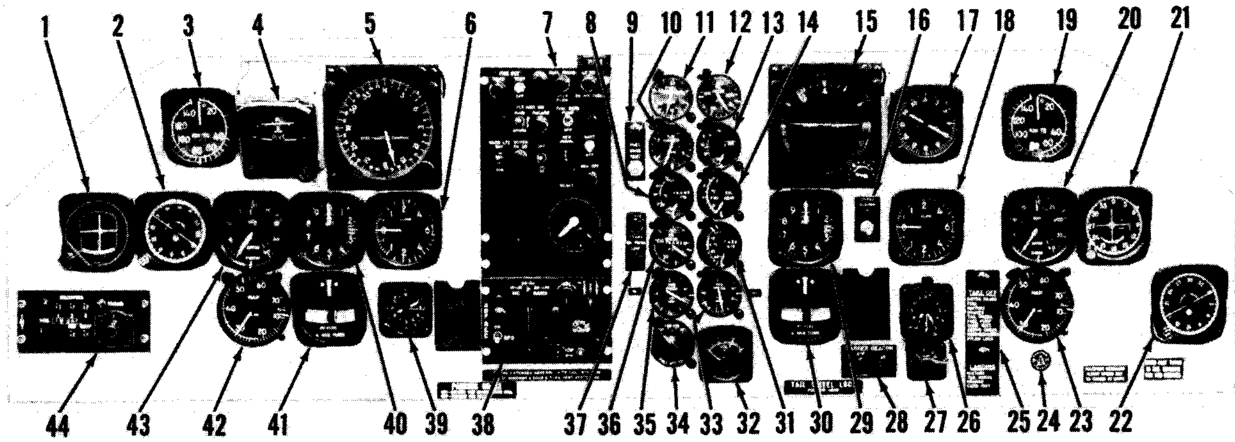
1. Signal Distribution Panel
2. Dual Tachometer
3. Airspeed Indicator
4. Main Switch Panel
5. Transmission Oil Temperature Gage
6. Fuel Gage Test Switch
7. Fuel Pressure Gage
8. Fuel Quanity Gage
9. Engine Oil Pressure Gage
10. Engine Oil Temperature Gage
11. Cylinder Head Temperature Gage
12. Directional Indicator
13. Directional Indicator Compass Slaving Switch
14. J-8 Attitude Indicator
15. Vertical Velocity Indicator
16. Airspeed Indicator
17. Dual Tachometer
18. Radio Compass Indicator
19. Manifold Pressure Gage
20. Manifold Pressure Purge Button
21. Checklist
22. Clock
23. Ammeter
24. Marker Beacon Volume Control and Light
25. Altimeter
26. Turn-and-Bank Indicator
27. Carburetor Air Temperature Gage
28. Auxiliary Servo Hydraulic Pressure Gage
29. Voltmeter
30. Fuel Quantity Selector Switch
31. Primary Servo Hydraulic Pressure Gage
32. Transmission Oil Pressure Gage
33. Transmission Oil Low Pressure Warning Light
34. AN/ARN-6 Control Panel
35. Manifold Pressure Gage

Figure 2–10. Instrument Panel (Typical) (Helicopters Serial No. Prior to 57-1742)

gine shaft and the upper end is bolted to a rubber coupling at the lower end of the drive shaft of the main gear box. The clutch consists of a fluid coupling and a mechanical coupling incorporating a freewheeling unit. The functions of the fluid coupling are to permit the engine to be started and operated while completely disengaged from the transmission and rotor systems, and to provide a smooth acceleration of the transmission and rotor systems at the time of clutch engagement. The mechanical coupling provides a direct connection between the engine shaft and the main drive shaft after the latter has been accelerated to engaging speed by the fluid coupling. The freewheeling unit eliminates drag during autorotation by automatically disengaging when engine speed falls below the equivalent main rotor speed. An electric pump, located on top of the left engine oil tank, pumps oil from the tank beneath it into the fluid coupling housing to provide the medium through which engine torque is gradually transmitted to the transmission drive shaft. The pump operates on direct current from the primary bus.

2–38. On helicopter serial No. 56–4313 and subsequent, a clutch oil diverter valve replaces the clutch oil pump and is installed on the right-hand side of the helicopter above the right-hand oil tank. This valve diverts warm engine oil under pressure directly to the fluid coupling of the clutch. The diverter valve is also powered by direct current from the primary bus. For a detailed explanation of the operation of the clutch, refer to paragraph 2–18, Chapter 9.

2–39. CLUTCH SWITCH AND WARNING LIGHT. (See figure 2–13.) The clutch switch is located in a box on the right-hand side of the control console. The switch has two positions, CLUTCH and OFF. The switch controls the clutch pump. When the switch is in the CLUTCH position, it actuates the electrically driven hydro-mechanical clutch pump, and when it is in the OFF position, power to the pump is disconnected. A press-to-test warning light forward of the switch will go on when the switch is in the CLUTCH position. The clutch



1. Cross-Pointer Indicator
2. Radio Compass Indicator
3. Airspeed Indicator
4. J-8 Attitude Indicator
5. Directional Indicator
6. Vertical Velocity Indicator
7. Main Switch Panel
8. Transmission Oil Temperature Gage
9. Fuel Gage Test Switch
10. Fuel Quanity Gage
11. Fuel Pressure Gage
12. Engine Oil Pressure Gage
13. Engine Oil Temperature Gage
14. Cylinder Head Temperature Gage
15. B-1A Attitude Indicator
16. Directional Indicator Compass Slaving Switch
17. Directional Indicator
18. Vertical Velocity Indicator
19. Airspeed Indicator
20. Dual Tachometer
21. Course Indicator
22. Radio Compass Indicator
23. Manifold Pressure Gage
24. Manifold Pressure Purge Button
25. Checklist
26. Clock
27. Ammeter
28. Marker Beacon Volume Control and Light
29. Altimeter
30. Turn-and-Bank Indicator
31. Carburetor Air Temperature Gage
32. Voltmeter
33. Auxiliary Servo Hydraulic Pressure Gage
34. Fuel Quanity Selector Switch
35. Primary Servo Hydraulic Pressure Gage
36. Transmission Oil Pressure Gage
37. Transmission Oil Low Pressure Warning Light
38. ADF Control Panel
39. Clock
40. Altimeter
41. Turn-and-Bank Indicator
42. Manifold Pressure Gage
43. Dual Tachometer
44. Signal Distribution Panel

Figure 2–11. Instrument Panel (Typical) (Model CH-34C Serial No. 57-1742 and Subsequent)

warning light may be tested by pressing in on the light.

2–40. On helicopter serial No. 56–4313 and subsequent, operation of the diverter valve is controlled by the clutch switch. The two positions CLUTCH and OFF indicate whether or not power to the diverter valve is being supplied. A press-to-test warning light forward of the switch will go on when the switch is in the CLUTCH position. The clutch warning light may be tested by pressing in on the light.

2–41. MAIN GEAR BOX. (See figure 2–12.)

2–42. The main gear box in the transmission system is mounted above the cabin. The gear box contains bevel gears and a single-stage planetary gear system which reduce engine rpm at a ratio of approximately 11.3 to 1.0 for driving the main rotor. Additional shafting extends from the main gear box lower housing through the intermediate gear box and tail rotor gear box to drive the tail rotor. The main gear box accessory drive section, located at the rear of the gear box lower housing, drives the primary servo hydraulic pump, the main rotor tachometer-generator, the main gear box oil pump, the generator, the generator blower, and the rescue hoist hydraulic pump.

2–43. INTERMEDIATE AND TAIL ROTOR GEAR BOXES. (See figure 2–12.)

2–44. The intermediate gear box in the transmission system is located at the lower portion of the tail rotor pylon. The tail rotor gear box is located at the top of the pylon. Both gear boxes contain bevel gears to change the direction of the shafting that transmits engine torque to the tail rotor. The tail rotor gear box contains part of the tail rotor pitch change linkage which extends through the hollow gear box output shaft to the tail rotor hub.

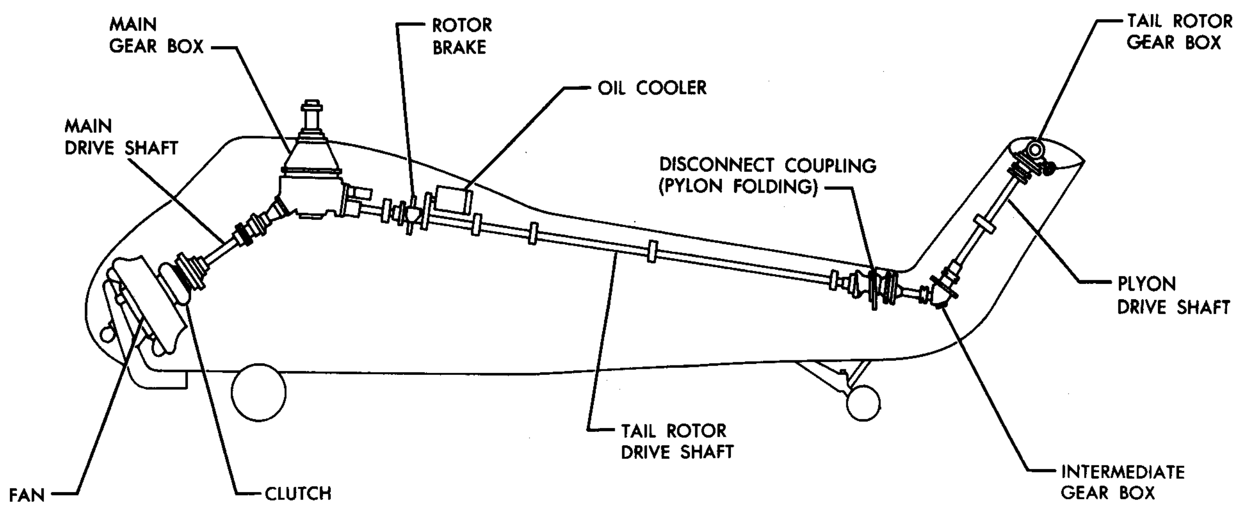


Figure 2–12. Transmission System

2–45. ROTOR BRAKE. (See figure 2–12.)

2–46. A hydraulically actuated rotor brake is located in the transmission system. The rotor brake is mounted on the tail rotor drive shaft aft of the main gear box, and stops the rotation of the rotors and prevents rotation when the helicopter is parked. The rotor brake lever and hydraulic cylinder (4, figure 2–5) is located in the pilots' compartment to the right of the overhead switch panel. The brake lever and hydraulic cylinder is equipped with its own filler cap and operates independently from either of the servo hydraulic systems. A rotor brake accumulator (12, figure 2–29), connected to the rotor brake hydraulic tubing at the forward end of the transmission compartment, assures continuous hydraulic pressure when the rotor brake is applied. The accumulator is charged with approximately 250 psi air pressure.

2–47. ROTOR BRAKE LEVER. (See figure 2–14.) A rotor brake lever (1) is connected directly to the rotor brake cylinder (2) on the pilots' compartment ceiling to the right of the overhead switch panel. The lever is marked ROTOR BRAKE. The rotor brake is applied by pulling down and forward on the lever. A spring-loaded lockpin (3), located at the forward outboard side of the cylinder, automatically locks the brake lever in the applied (forward) position. For normal shutdown, the rotor brake should be applied gradually by slowly moving the rotor brake lever forward toward the full ON position after the clutch is disengaged. For emergency shutdown, the rotor brake lever may be forced into the full ON position after closing the throttle. The rotor brake when fully applied, in event of an emergency, is designed to stop the rotors from hovering rpm in 15 seconds. To release the rotor brake, pull out on the lockpin and swing the lever aft and up against the bottom of the cylinder until it snaps into place. The lockpin may be rendered inoperative by rotating it until it remains in the out position.

CAUTION

When releasing rotor brake, be sure that lever snaps into detent at unlocked position to prevent partial application of rotor brake due to weight of rotor brake lever.

2–48. CLUTCH – ROTOR BRAKE INTERLOCK. To reduce the possibility of clutch engagement while the rotor brake is on, a hydraulically activated pressure switch has been installed. When the rotor brake is on, hydraulic pressure builds up in the lines and activates a pressure switch which breaks the electrical circuit to the hydro-mechanical clutch pump. This makes it impossible to engage the clutch unless the rotor brake lever is in the full detent or OFF position.

2–49. On helicopters serial No. 56-4313 and subsequent, the pressure switch will break the electrical circuit to the clutch diverter valve, thus making clutch engagement impossible.

2–50. ROTOR BRAKE WARNING LIGHT. (See figure 2–16.) A rotor brake warning light is located on the main switch panel. The warning light is marked ROTOR BK ON. The light is designed to aid in prevention or rotor engagement with the rotor brake engaged. When the rotor brake is on and power is applied to the primary bus, the light

Figure 2–13. Clutch Switch and Cargo Sling Master Switch

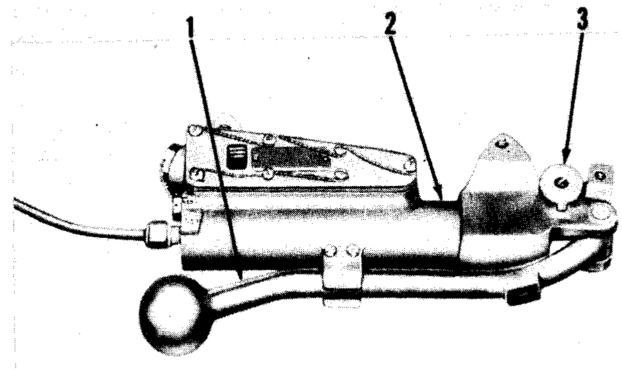
will come on. When the rotor brake is off, the light will go out.

2–51. ROTOR SYSTEM.

2–52. The rotor configuration of this helicopter consists of a single, main lifting rotor system and an anti-torque tail rotor system. Both systems are driven by the engine through the transmission system and are controlled by the flight control system.

2–53. MAIN ROTOR SYSTEM.

2–54. The main rotor system consists of the main rotor head assembly and the main rotor blades.



1. Rotor Brake Lever
2. Rotor Brake Cylinder
3. Lockpin

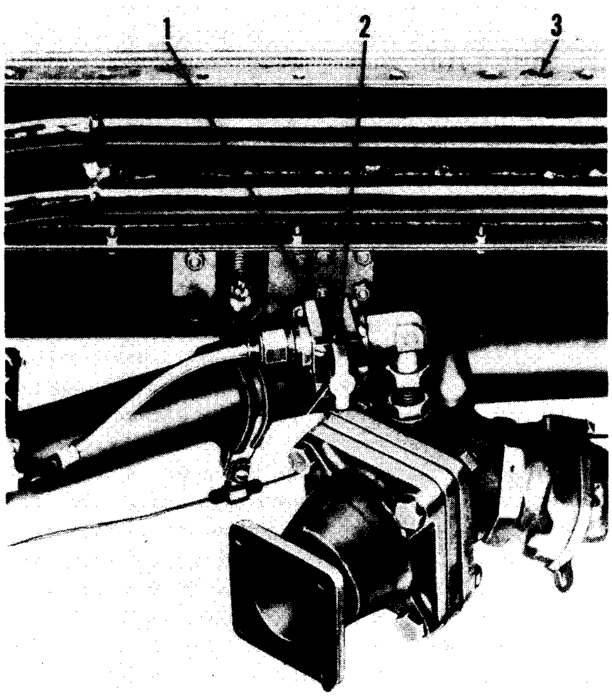
Figure 2–14. Rotor Brake Lever

The main rotor head assembly, mounted directly above the main gear box, consists of a hub assembly and a star assembly. The hub assembly, consisting of four sleeve-spindle assemblies and four hydraulic dampers clamped between two parallel plates, is splined to the main rotor drive shaft. The root ends of the four main rotor blades are attached to the sleeve-spindle assemblies which permit each blade to flap vertically, hunt horizontally, and rotate about their spanwise axis to change the angle of incidence. Anti-flapping restrainers limit the upward movement of the blades caused by wind pressure when the blades are stopped or turning at low speed. When rotor speed is increased to approximately 60 rpm, centrifugal force automatically releases the anti-flapping restrainers. Droop restrainers attached to the hub limit the downward movement of the blades about the hinges when the blades are stopped or turning at low rpm. When rotor rpm is increased to approximately 160 rpm, the restrainers are automatically released and the blades are supported by the combination of centrifugal force and lift. The hydraulic dampers minimize hunting movement of the blades about the vertical hinges as the blades rotate, prevent shock to the blades when the rotor is started or stopped, and aid in the prevention of ground resonance. The angle of incidence, or pitch, of the main rotor blades is controlled by the main rotor flight control system which is connected to the blades through a star assembly located below the main rotor hub. The star assembly consists of an upper (rotating) star which is driven by the main rotor hub and a lower (stationary) star which is secured by a scissors assembly to the main gear box. Both stars are mounted on a ballring and socket assembly which keeps them parallel at all times, but allows them to be tilted, raised, or lowered simultaneously by components of the main rotor flight control system which connect to arms

on the power (stationary) star. Cyclic or collective pitch changes introduced at the stationary star are transmitted to the rotating star and then to the blades by linkage on the rotating star. The four, all-metal, main rotor blades are constructed entirely of aluminum alloy except for forged steel cuffs which attach the blades to the sleeve-spindle assemblies on the main rotor hub assembly. The spar of the blade is a hollow aluminum alloy extrusion which forms the leading edge of the blade. Individual pockets, constructed of sheet aluminum alloy, form the trailing edge of the blades. The pockets are bonded to the spar.

2–55. TAIL ROTOR SYSTEM.

2–56. The tail rotor system consists of the tail rotor hub, a blade pitch-change mechanism, and four all-metal rotor blades. The tail rotor hub is splined to the tail rotor gear box drive shaft which transmits engine torque to the blades. The four tail rotor blades are attached to the hub by flapping hinges and spindles so that they are free to flap and rotate about their spanwise axis for pitch variation. The blade pitch changing mechanism transmits tail rotor pedal control movements to the blades through the hollow tail rotor drive shaft. The four all-metal tail rotor blades are constructed of a one-piece wrap-around skin bonded to a solid leading edge spar. The skin is bonded together at the trailing edge and forms an integral part of the blade structure.



1. Oil Dilution Shutoff Valve
2. Oil Dilution Shutoff Valve Hanele
3. Oil Cooler

Figure 2–15. Oil Dilution Manual Shutoff Valve

2–57. ENGINE OIL SYSTEM.

2–58. The engine oil system includes two interconnected oil tanks located in the left- and right-hand bottom structure of the clutch compartment forward of the forward bulkhead, and an oil cooler located between the tanks. Tubing connects these units to the engine-driven oil pump. For oil specification and grade, see figure 2–29.

2–59. OIL TANKS.

2–60. The two interconnected bladder-type engine oil tanks (10, figure 2–29) have a capacity of 10.5 US gallons with a 6.9 US gallon expansion space. The oil filler cap is located on the right-hand side of the fuselage below the air intake screens. A dipstick for measuring oil quantity is attached to the filler cap. The oil tanks may be drained by opening a valve located forward of the oil cooler.

CAUTION

When servicing oil tanks, fill to mark on dipstick and allow time for oil to seek its own level in both tanks. Recheck oil level and refill as necessary. This procedure will assure proper oil level in tanks.

2–61. OIL COOLER. (See figure 2–9.)

2–62. Operation of the oil cooler for the engine cooling and air induction system is entirely automatic. During cold engine starts, when the oil is cold, extremely high oil pressures can be encountered until the oil has warmed up. To protect the core of the oil cooler from these high oil pressures, a thermostatically operated oil cooler control valve closes the oil intake port to the cooler and directs the flow of the oil from the engine outlet back to the oil tanks. As the engine warms up and oil temperatures increases, the warm oil contacts the thermostat which slowly opens the valve to the intake port of the cooler and allows some warm oil to flow into an external channel along the side of the core of the cooler. This flow of oil warms the oil in the core of the cooler. As oil temperature increased, the valve opens fully and all oil flows through the core. Thermostatically operated shutters on the oil cooler control the oil temperature by regulating the flow of air through the core. Air for the oil cooler is drawn into the engine compartment by the fan and passes through a duct to the oil cooler. After passing through the

Figure 2–16. Main Switch Panel

core, the air is exhausted through the opening in the bottom of the fuselage.

2–63. OIL DILUTION SWITCH. (See figure 2–16.)

2–64. A spring-loaded switch is located on the main switch panel. The switch has two positions marked OIL DIL and OFF. When the switch is held in the OIL DIL position, direct current from the primary bus actuates a valve which allows fuel to flow into the engine oil inlet line. When the switch is released, it returns to the center OFF position and oil dilution stops. The switch is protected by a circuit breaker, marked OIL DIL, located on the overhead circuit breaker panel. For oil dilution procedures, refer to paragraph 3–8, Chapter 10.

2–65. OIL DILUTION MANUAL SHUTOFF VALVE HANDLE. (See figure 2–15.)

2–66. A manually operated oil dilution shutoff valve (1) is inserted in the oil dilution line forward of the oil cooler (3) as a precaution against accidental draining of fuel into the oil system. The oil dilution shutoff valve handle (2) has two marked positions, OPEN and CLOSED. When the shutoff valve handle is placed in the OPEN position, oil dilution can be accomplished by use of the oil dilution switch. When the shutoff valve handle is placed in the CLOSED position, oil dilution cannot be accomplished. The shutoff valve handle should be left in the OPEN position at all times when operating in climatic conditions requiring oil dilution.

2–67. TRANSMISSION OIL SYSTEM.

2–68. The three gear boxes have individual oil systems. Each gear box has an oil filler, a drain plug, and an oil level sight gage. For oil specification and grade, see figure 2–29.

2–69. MAIN GEAR BOX OIL SYSTEM.

2–70. The main gear box is lubricated by a pressure-type oil system. Pressure is supplied by a gear-type oil pump driven by the accessory drive section on the lower housing of the main gear box. Oil is pumped through an oil filter and then to the oil cooler where oil temperature is automatically controlled by a thermostatically operated valve which directs the flow of oil either through the core of the oil cooler when the oil is hot, or bypasses the oil cooler when the oil is cold. The oil cooler in the transmission system (figure 2–12) is mounted aft of the main gear box, and consists of the thermostatically controlled valve, a core, and a blower which forces cooling air through the core. The blower is belt-driven from the tail drive shaft. After leaving the cooler, the oil is pumped to the gear box and is sprayed through jets onto the gears. A push-button oil level inspection light switch is located on the bulkhead forward and at the left-hand side of the main gear box. The switch controls a light to aid in inspecting the gear box oil level sight gage.

2–71. TRANSMISSION OIL TEMPERATURE GAGE. (See figures 2–10 and 2–11.) The transmission oil temperature gage (5, figure 2–10 and 8, figure 2–11) is located on the instrument panel. The gage indicates oil temperature in degrees centigrade. The transmission oil temperature bulb is located on the oil outlet side of the main gear box. The gage operates on direct current from the primary bus and is protected by a circuit breaker located on the overhead circuit breaker panel, marked XMSN OIL. For operating limitations, refer to paragraph 2–19, Chapter 7.

2–72. TRANSMISSION OIL PRESSURE GAGE. The transmission oil pressure gage (32, figure 2–10 and 36, figure 2–11) is located on the instrument panel. The gage indicates oil pressure in psi at the main gear box inlet port and operates on current from the 26-volt alternating current bus.

2–73. TRANSMISSION OIL LOW PRESSURE WARNING LIGHT. A red warning light (33, figure

affect the battery bus which is connected to the battery at all times.

2–108. GENERATOR SWITCH. (See figure 2–16.)

2–109. A guarded generator switch is located on the main switch panel. The switch is marked GEN with the positions, GEN, OFF and RESET. When the switch is placed in the GEN position and the generator is up to operating speed, generator output is connected to the primary bus. The secondary bus is also energized by means of the bus tie relay which is closed by the reverse current relay when the generator reaches operating speed. If generator voltage should become too high, the overvoltage relay and generator field control relay will disconnect the generator from the primary bus and break the circuit to the generator field. The primary bus is then energized by the battery (if the battery switch is in the BATT position), but the secondary bus will be inoperative. The momentary RESET position of the switch is used to reset the trip coil of the field control relay after an overvoltage condition has energized the trip coil and disconnected the circuit between the generator and the generator field. When this condition occurs, the switch is held momentarily to RESET and then placed in the GEN position. The OFF position cuts off generator output by disconnecting the circuit between the generator and the generator field.

2–110. AMMETER.

2–111. The ammeter (23, figure 2–10 and 27, figure 2–11) is located on the instrument panel. The ammeter indicates the current being drawn from the generator.

2–112. VOLTMETER.

2–113. A voltmeter (29, figure 2–10 and 32, figure 2–11) is located on the instrument panel. The voltmeter indicates dc voltage in the primary bus.

2–114. GENERATOR FAILURE WARNING LIGHT. (See figure 2–16.)

2–115. The generator failure warning light is located to the right of the generator switch on the main switch panel. The light is marked GEN OFF. The light is on when the primary bus is energized by either an external power source or by the battery. The light is off when the primary bus is either dead or energized by the generator. In normal flight operations with the battery switch and the generator switch turned on, the warning light will come on when generator voltage falls below battery voltage, indicating partial or complete generator failure. The warning light may be tested for operation by pressing in on the light.

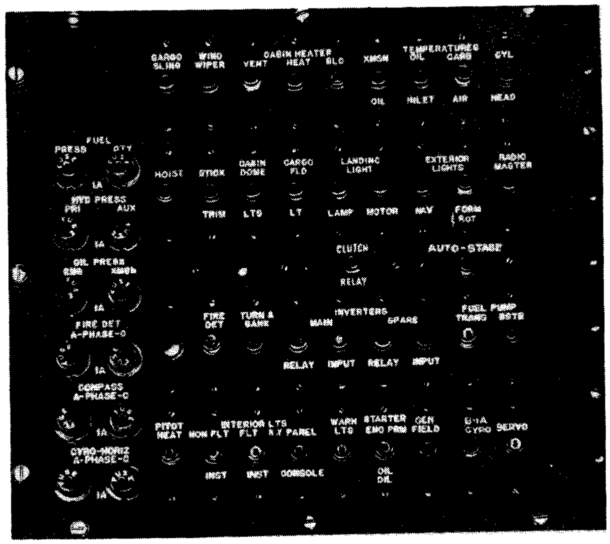


Figure 2–21. Overhead Circuit Breaker and Fuse Panel

2–116. CIRCUIT BREAKERS.

2–117. OVERHEAD CIRCUIT BREAKER AND FUSE PANEL. (See figure 2–21.) The overhead circuit breaker and fuse panel is located overhead in the pilots' compartment between the pilot and copilot. Each circuit breaker is marked to correspond to the circuit that it protects. Primary bus circuit breakers are located on the forward part of the panel and secondary bus circuit breakers are on the aft part. All circuit breakers on the overhead panel are of the push-pull type and can be reset. Any malfunctioning dc electrical circuit may be turned off and isolated from the electrical system by pulling out its circuit breaker.

2–118. GROUND CHECK RELAY AND IGNITION VIBRATOR CIRCUIT BREAKERS. (See figure 2–22.) Two circuit breakers are located on the dc power relay junction box on the right-hand side of the forward bulkhead in the electronics compartment. The circuit breakers are marked GRD CHK RELAY and IGN VIBRATOR.

2–119. On helicopters serial No. 56–4313 and subsequent and on Model CH-34C, the junction box is located in the left aft end of the clutch compartment.

2–120. BATTERY BUS CIRCUIT BREAKER BOX. (See figure 2–22.) The battery bus circuit breaker box is mounted on top of the dc power

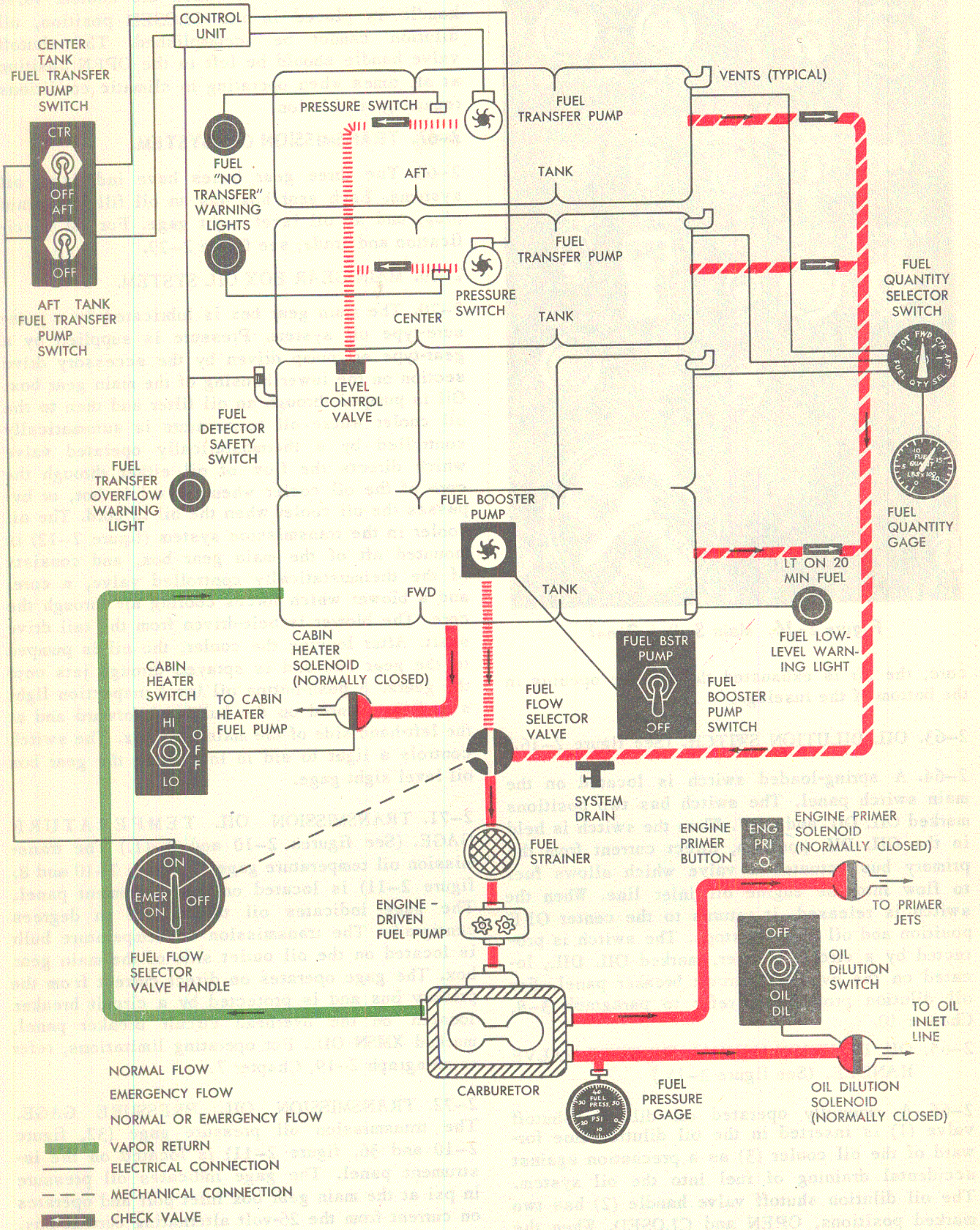


Figure 2–17. Fuel System

2–10 and 37, figure 2–11) is located on the instrument panel. The light is marked TRANS OIL PRESS. LOW and lights when oil pressure for the main gear box drops below allowable limits. When the warning light goes on, immediate landing should be made because of the dangerously low oil pressure in the main gear box. Flight should not be resumed until the reason for the low pressure is known and corrected. The oil pressure warning light may be tested for operation by pressing in on the light, marked PRESS-TO-TEST. The light operates on direct current from the primary bus.

2–74. INTERMEDIATE AND TAIL ROTOR GEAR BOX OIL SYSTEMS.

2–75. Both the intermediate gear box and the tail rotor gear box are splash-lubricated and have no controls or indicators.

2–76. FUEL SYSTEM. (See figures 2–17 and 2–29.)

2–77. The helicopter is equipped with a transfer-type fuel system (figure 2–17). Fuel is carried in three multi-cell fuel tanks which are located in the forward fuselage section below the cabin floor. Each tank is vented by lines that extend upward through the side panels of the fuselage. The forward fuel tank (11, figure 2–29) consists of five self-sealing, interconnected cells, and the center and aft fuel tanks (13 and 15) each consist of three interconnected bladder-type cells. Each tank has a filler unit located on the right-hand side of the fuselage. Fuel is transferred from the aft and center tanks into the forward tank by a transfer pump located in the sump of each tank. The fuel transfer pumps are individually controlled by switches in the pilots' compartment. A level control valve in the forward tank prevents overflowing by closing the fuel transfer line when the forward tank is full. When the forward tank level control valve is closed, the transfer pumps continue to operate, but an internal bypass in the pumps prevents pressure from building up. A fuel detector safety switch in a forward tank vent line automatically shuts off the fuel transfer pumps and turns on an overflow warning light should the level control valve become jammed in the open position and allow the fuel level in the forward tank to rise to the level of the switch. Either of two no-transfer warning lights, one for the aft tank and one for the center tank, will light when the corresponding tank is empty, or its booster pump has failed or has been turned off by the fuel detector safety switch. The fuel booster pump, located in the sump of the forward tank, pumps fuel into the main fuel line under pressure to prevent air locks in the system. In case of electrical failure or electrical pump failure, fuel can be delivered from all tanks through an emergency gravity feed fuel system. Fuel for operating the cabin heater is drawn from the forward tank. All fuel pumps and warning lights operate on direct current from the primary bus.

2–78. FUEL SPECIFICATION AND GRADE.

2–79. For fuel specification and grade, see figure 2–29.

2–80. FUEL FLOW SELECTOR VALVE HANDLE. (See figure 2–8.)

2–81. The mechanical-type fuel flow selector valve handle (1) is mounted on the engine control console immediately aft of the engine quadrant. The handle has three marked positions, ON, EMER ON, and OFF. When the handle is placed in the ON position, it opens a valve in the main fuel line from the forward tank to the engine and closes an electrical switch that renders the fuel transfer pump switches operative. The EMER ON position of the selector valve handle is used in event of electrical failure or failure of the transfer pumps. When the selector valve handle is placed in the EMER ON position, the two transfer pumps are shut off and fuel will flow from all tanks by gravitational force through emergency lines running to the fuel flow selector valve. The engine-driven fuel pump will supply fuel at sufficient pressure, to the carburetor for normal operation; however, sustained nose-up flight attitudes should be avoided to prevent possible fuel starvation in the gravity feed system. The OFF position of the selector valve handle shuts off the fuel flow to the engine and turns off any transfer pump that may be in operation.

2–82. FUEL BOOSTER PUMP SWITCH. (See figure 2–16.)

2–83. The fuel booster pump switch is located on the main switch panel. The switch has two positions marked FUEL BSTR PUMP and OFF. When the switch is in the FUEL BSTR PUMP position, it actuates the fuel booster pump which operates on direct current from the primary bus. The pump is installed in the sump of the forward fuel tank to prevent vapor locks in the system by supplying fuel under pressure to the engine-driven fuel pump. The booster pump should be used during starting, ground operation, and in flight below 2000 feet and above 8000 feet. The engine-driven fuel pump or the fuel booster pump alone can supply fuel to the carburetor at sufficient pressure for normal engine operation if either pump should fail. The switch is placed in the OFF position to shut off the pump.

TABLE 2-I
FUEL QUANTITY DATA (U S GALLONS)

TANK	USABLE	FULLY SERVICED
FWD	100	101
CENTER	70	70
AFT	92	92
TOTAL	262	263

NOTE

1. Fuel quantities are actual values for a 3° nose down flight attitude.
2. Fuel density 6 pounds per gallon at standard conditions 15°C (59°F).

2-84. FUEL TRANSFER PUMP SWITCHES. (See figure 2-18.)

2-85. Two fuel transfer pump switches and two no-transfer warning lights are located on a box, marked FUEL TRANS PUMPS, at the right of the radio panels. The switches are marked CTR, OFF, and AFT, OFF. The switches control the fuel transfer pumps in the center and aft tanks respectively. Direct current from the primary bus operates the fuel transfer pumps through a control unit located in the electronics compartment. The switches are operative only when the fuel flow selector valve handle is placed in the ON position. When one switch is placed in the AFT position or the other switch is placed in the CTR position, the corresponding fuel transfer pump is turned on. When either switch is placed in the OFF position, the corresponding fuel transfer pump is turned off.

CAUTION

To avoid exceeding cg limitations, first transfer fuel from aft tank to forward tank. When aft tank is empty, shut off aft fuel transfer pump switch and turn on center fuel transfer pump switch to transfer pump switch to transfer fuel from center tank to forward tank.

2-86. FUEL QUANTITY SELECTOR SWITCH. (See figures 2-10 and 2-11.)

2-87. A rotary fuel quantity selector switch (30, figure 2-10 and 34, figure 2-11) is located on the instrument panel. The selector switch is marked FUEL QTY SEL and has four marked positions: TOT, FWD, CTR, and AFT. When the switch is placed in the TOT position, the fuel quantity gage will indicate the total amount of

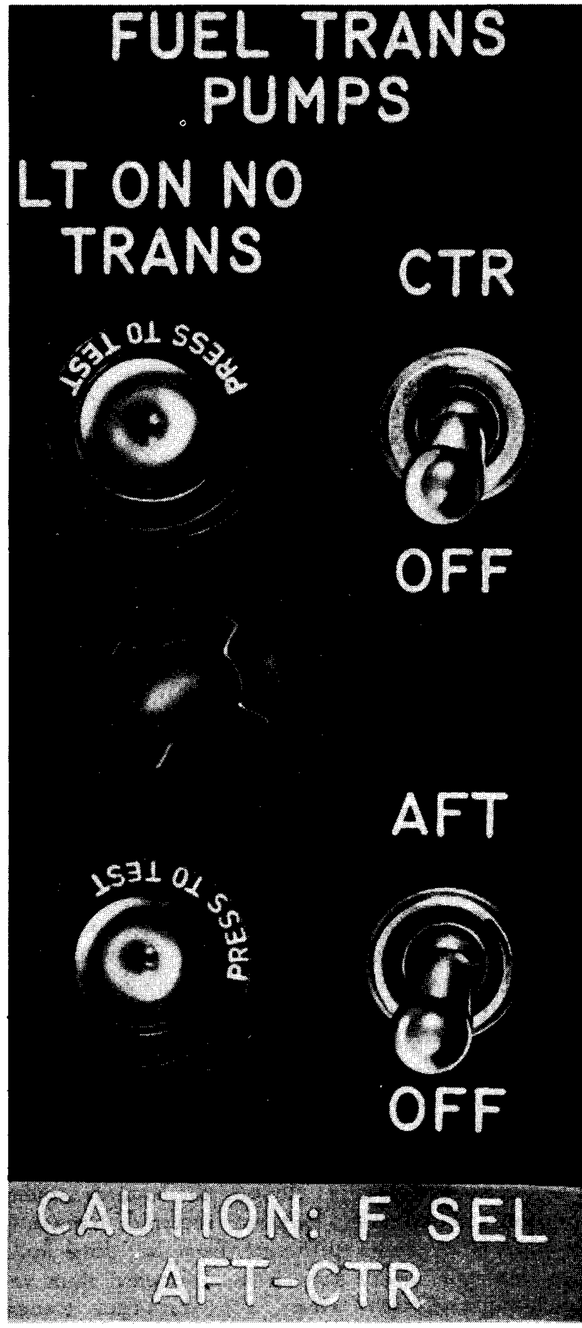


Figure 2-18. Fuel Transfer Pump Switches and No-Transfer Warning Lights

fuel in all tanks. When the switch is placed in any other position, the gage will indicate only the amount of fuel in the selected tank.

2-88. FUEL QUANTITY GAGE AND TEST SWITCH.

2-89. The fuel quantity gage (8, figure 2-10 and 10, figure 2-11) is located on the instrument panel. The gage indicates the total fuel quantity

or the quantity in each tank in pounds. The tank unit capacitance system used in this helicopter is practically unresponsive to volumetric changes resulting from various temperatures. No moving parts are used in the fuel tank but instead, the dielectric properties of the fuel are utilized to furnish a measurement of fuel quantity. This system measures the voltage drop between two electrodes in the tank units. The dielectric between the two electrodes, part air and part fuel, will vary as the fuel varies. The fuel quantity gage is calibrated to measure this voltage drop in pounds of fuel. Refer to table 2–I for fuel quantity data. The fuel quantity indicating system may be tested by pressing the fuel gage test switch (6, figure 2–10 and 9, figure 2–11), marked FUEL GAGE TEST, located to the left of the gage. In order to test the whole system at once, the fuel quantity selector switch should first be placed in the TOT position. Pressing the test switch for approximately 10 seconds will induce a current reversal which causes the pointer to turn counterclockwise toward zero. Upon release of the test switch, the normal current should cause the pointer to return to the previous reading. This test shows that the fuel quantity indicating system is operating correctly. The fuel quantity indicating system operates on current from the 115-volt alternating current bus.

2–90. FUEL LOW-LEVEL WARNING LIGHT. (See figure 2–16.)

2–91. The fuel low-level warning light is located on the main switch panel. The light is marked LT ON, 20 MIN FUEL. The light will go on when there are 22 gallons (132 pounds) of fuel remaining in the forward tank. This is sufficient fuel for 20 minutes flight at 2300 engine rpm and 31 inches Hg manifold pressure. The warning light operates on direct current from the primary bus. The fuel low-level warning light may be tested for operation by pressing in on the light.

Note

Fuel low-level warning light does not indicate fuel remaining in center or aft tanks, or if emergency gravity feed system is in operation. Use fuel quantity gage and selector switch periodically to determine total fuel remaining.

2–92. FUEL NO-TRANSFER WARNING LIGHTS. (See figure 2–18.)

2–93. An amber no-transfer warning light is located at the left of each fuel transfer pump switch. The light is marked LT ON, NO TRANS. These lights, one for the aft tank and one for the center tank, are operative only if the corresponding aft or center transfer pump switch is turned on. The warning lights are connected to pressure switches in the fuel lines extending from the aft and center tanks to the forward tank. When a fuel pressure drop occurs in either fuel line, the corresponding warning light will go on. A fuel pressure drop can occur (and the light go on) under three conditions:

a. When the forward fuel tank overflows and the overflow safety switch turns the overflow warning light on and the transfer pump off.

b. When the transfer pump has failed.

c. When the tank is empty.

The aft or center no-transfer warning lights will go out when the corresponding transfer pump switch is turned off. The no-transfer warning lights operate on direct current from the primary bus and may be tested for operation by pressing in on the light. A further description of the fuel transfer system is included in paragraph 2–24, Chapter 9.

2–94. FUEL TRANSFER OVERFLOW WARNING LIGHT. (See figure 2–16.)

2–95. A red warning light is located on the main switch panel. The light is marked FUEL TRANS OVERFLOW. The light will be turned on by the fuel detector safety switch if the level control valve in the forward tank malfunctions and allows the fuel being transferred from the aft or center tank to flood the forward tank. At the same time, the fuel transfer pump in operation will be automatically turned off, through a connection to the fuel pump control unit, and the corresponding fuel no-transfer warning light will be turned on. The overflow warning light operates on direct current from the primary bus and may be tested for operation by pressing in on the light.

2–96. ELECTRICAL POWER SUPPLY SYSTEM. (See figure 2–19.)

2–97. Electrical power is supplied by two basic electrical systems: a 28-volt direct current system and a 115-volt 400-cycle alternating current system.

2–98. DIRECT CURRENT POWER SUPPLY SYSTEM.

2–99. GENERATOR. (See figure 2–3.) The main power source for the operation of dc equipment is the 28-volt, 200-ampere generator (6). The generator is driven by a takeoff on the accessory drive section at the aft end of the main gear box and is inoperative until after the hydro-mechanical clutch is engaged and rotor speed reaches approximately the equivalent of 1400 engine rpm. The generator is protected by a voltage regulator, an overvoltage relay, and field control relay. The voltage regula-

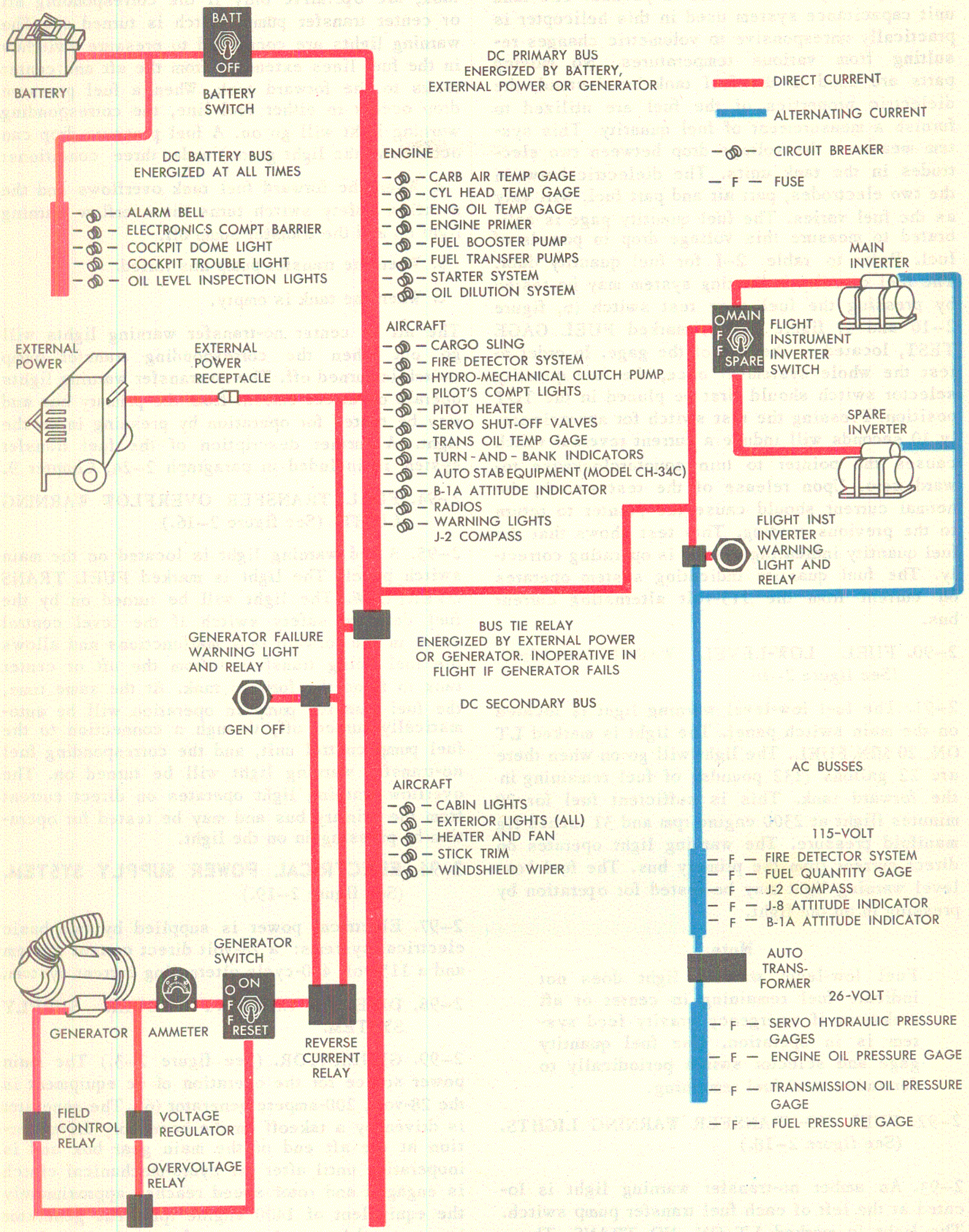


Figure 2–19. Electrical System

tor maintains a constant generator output of 28 volts dc under various engine speed or generator load conditions. The overvoltage relay protects the generator against a faulty voltage regulator by energizing a trip coil in the generator field control relay if generator voltage exceeds approximately 31 volts. The energizing of the trip coil in the field control relay disconnects the generator from the primary bus and breaks the circuit to the generator field. A reverse current cut-out disconnects the generator from the dc distribution system when generator output falls below battery or primary bus voltage.

2–100. BATTERY. (See figure 2–3.) A 24-volt, 36-ampere-hour battery (20) supplies power to the most essential electrical equipment when the generator has failed. The battery is located on the floor at the left side of the electronics compartment on Model CH-34A serial No. prior to 56–4313.

2–101. On helicopters serial No. 56–4313 and and subsequent on Model CH-34C, the 24-volt, 36-ampere-hour battery (26) is located just aft of the engine compartment directly below the flooring under the copilot's seat. The battery is contained in a battery box mounted on a sliding tray to simplify inspection and replacement. The junction box portion of the battery box has a double hinged door for easy access to the relays and connections.

2–102. EXTERNAL POWER RECEPTACLE. (See figure 2–2.) The external power receptacle (25) is located on the right-hand side of the fuselage outside of the electronics compartment on Model CH-34A serial No. prior to 56–4313. When an external source of 28-volt dc power is plugged into the external power receptacle, all dc equipment may be energized.

2–103. On helicopters serial No. 56–4313 and subsequent and on Model CH-34C, the external power receptacle (16) is located on the right-hand hand side of the fuselage just forward of the cargo door and is used for energizing all dc equipment.

2–104. DIRECT CURRENT DISTRIBUTION SYSTEM.

2–105. Direct current is distributed to dc electrical equipment throughout the helicopter by a primary bus, a secondary bus, and a battery bus. The primary bus supplies current to the most essential equipment. External power and the battery are connected directly to the primary bus. The reverse current cut-out connects the generator to the primary mary bus after the generator has reached operating speed (rotor speed equivalent to 1400 engine rpm). When external power is supplied through the ex-

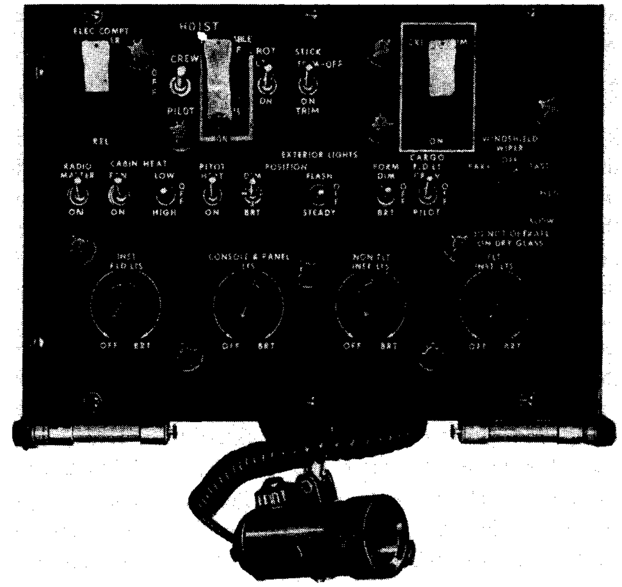


Figure 2–20. Overhead Switch Panel (Typical)

ternal power receptacle or when the generator is operating, the secondary and battery busses are energized through the primary bus. The secondary bus supplies power to the less essential electrical equipment and is connected to the primary bus by a bus tie relay. The bus tie relay is closed either through the external power receptacle when external power is connected or by the reverse current cut-out after the generator reaches operating speed. If external power is disconnected before the hydro-mechanical clutch is engaged, all equipment connected to the secondary bus will be inoperative since the secondary bus is energized only by the generator or by external power. If the generator fails in flight, with the battery switch in the BATT position, the secondary bus will become inoperative and the battery will supply power to the primary and battery busses. The secondary bus cannot be energized by the battery as battery power will not close the bus tie relay. The battery bus is connected directly to the battery, and equipment connected to the bus may be operated at all times.

2–106. BATTERY SWITCH. (See figure 2–16.)

2–107. The battery switch is located on the main switch panel. The switch has two positions marked BATT and OFF. When placed in the BATT position, this switch connects the battery to the primary bus either for energizing the bus or for charging the battery by the generator or external power. When the switch is placed in the OFF position, the battery is disconnected from the dc power system. The position of the battery switch does not

relay junction box located in the electronics compartment. Circuit breakers, protecting all dc circuits actuated by the battery bus, are located on the cover of the box. The circuit breakers are of the push-pull type.

2–121. On helicopters serial No. 56–4313 and subsequent and on Model CH-34C, the battery bus circuit breaker box is located on top of the power relay junction box in the clutch compartment.

2–122. ALTERNATING CURRENT POWER SUPPLY SYSTEM.

2–123. INVERTERS. (See figure 2–3.) Power to operate the ac electrical equipment is supplied by two 3-phase 250-VA inverters, one identified as the main inverter and the other as a spare. The two 250-VA inverters are replaced with two 500-VA inverters in those helicopters equipped with automatic stabilization equipment. Both inverters (19) are located on the floor at the right-hand side of the electronics compartment on Model CH-34A serial No. prior to 56–4313. Both inverters are powered by the primary dc bus, though only one is in operation at a time. The inverters are controlled by a switch on the main switch panel and may be turned on or off at any time. The system is not equipped with an automatic changeover relay; therefore, when the main inverter fails, the switch must be used to energize the spare inverter. The inverter supplies power to the 115-volt ac bus and to an autotransformer which reduces power to 26-volt ac for operating all electrical pressure gages.

2–124. On helicopters serial No. 56–4313 and subsequent and on Model CH-34C, the two inverters (25) which supply power to operate ac electrical equipment are mounted on top of the junction box portion of the battery box and can be inspected or removed through the lower air intake screen on the left-hand side of the helicopter. They can also be reached through the clutch access door.

2–125. ALTERNATING CURRENT DISTRIBUTION SYSTEM.

2–126. Alternating current is distributed to the ac electrical equipment throughout the helicopter by two busses: a 115-volt ac bus and a 26-volt ac bus. The 115-volt ac bus supplies power to an autotransformer which reduces voltage to 26 volts for operating the electrical pressure gages. Both ac busses receive their power from either the main or spare inverter, depending on which one is operating.

2–127. FLIGHT INSTRUMENT INVERTER SWITCH. (See figure 2–16.)

2–128. The inverter switch is located on the main switch panel. The switch is marked FLT INST INV, and has three marked positions, MAIN, OFF, and SPARE. The switch closes the direct current circuit from the primary bus to either the main or spare inverter. All ac equipment is connected to both inverters and is energized by the inverter in operation (main or spare). Normally, the switch is left in the MAIN position with the main inverter operating. If the main inverter should fail, as indicated by the instrument inverter failure warning light, the inverter switch is placed in the SPARE position. All dc current will be cut off from the main inverter and the spare inverter will be supplying alternating current to all equipment. When the switch is placed in the OFF position, the circuit is broken between both inverters and the primary bus.

2–129. FLIGHT INSTRUMENT INVERTER FAILURE WARNING LIGHT. (See figure 2–16.)

2–130. The warning light is located on the main switch panel. The light is marked FLT INST INV FAILURE. The light gives warning of failure of the inverter being used to supply power for all ac equipment. The light will come on momentarily when the primary bus is first energized, but will go out as soon as the inverter reaches operating speed. In flight, with the flight instrument inverter switch in the MAIN position, the light will come on in event of failure of the main inverter. The light will go out when the flight instrument inverter switch is moved to the SPARE position and power will be restored to all ac equipment. If the spare inverter should also fail, the light will come on and remain on regardless of the position of the switch. The light is of the press-to-test type and operates on direct current from the primary bus.

2–131. FUSES.

2–132. OVERHEAD CIRCUIT BREAKER AND FUSE PANEL. (See figure 2–21.) The main circuit breaker and fuse panel is located overhead in the pilots' compartment between the pilot and copilot. Each fuse is marked to correspond to the circuit that it protects. Fuses for the ac instrument

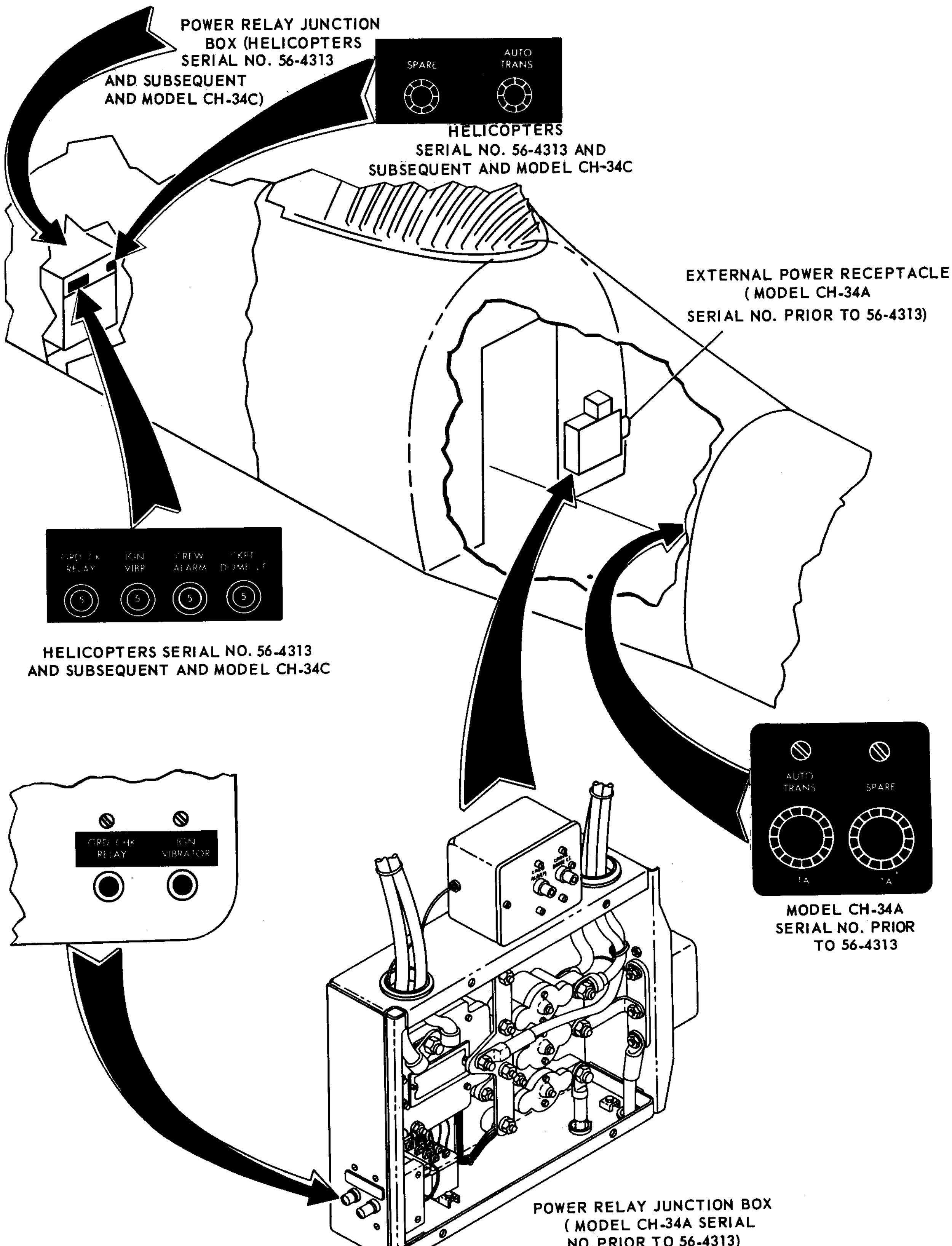


Figure 2–22. Circuit Breakers and Junction Box Diagram

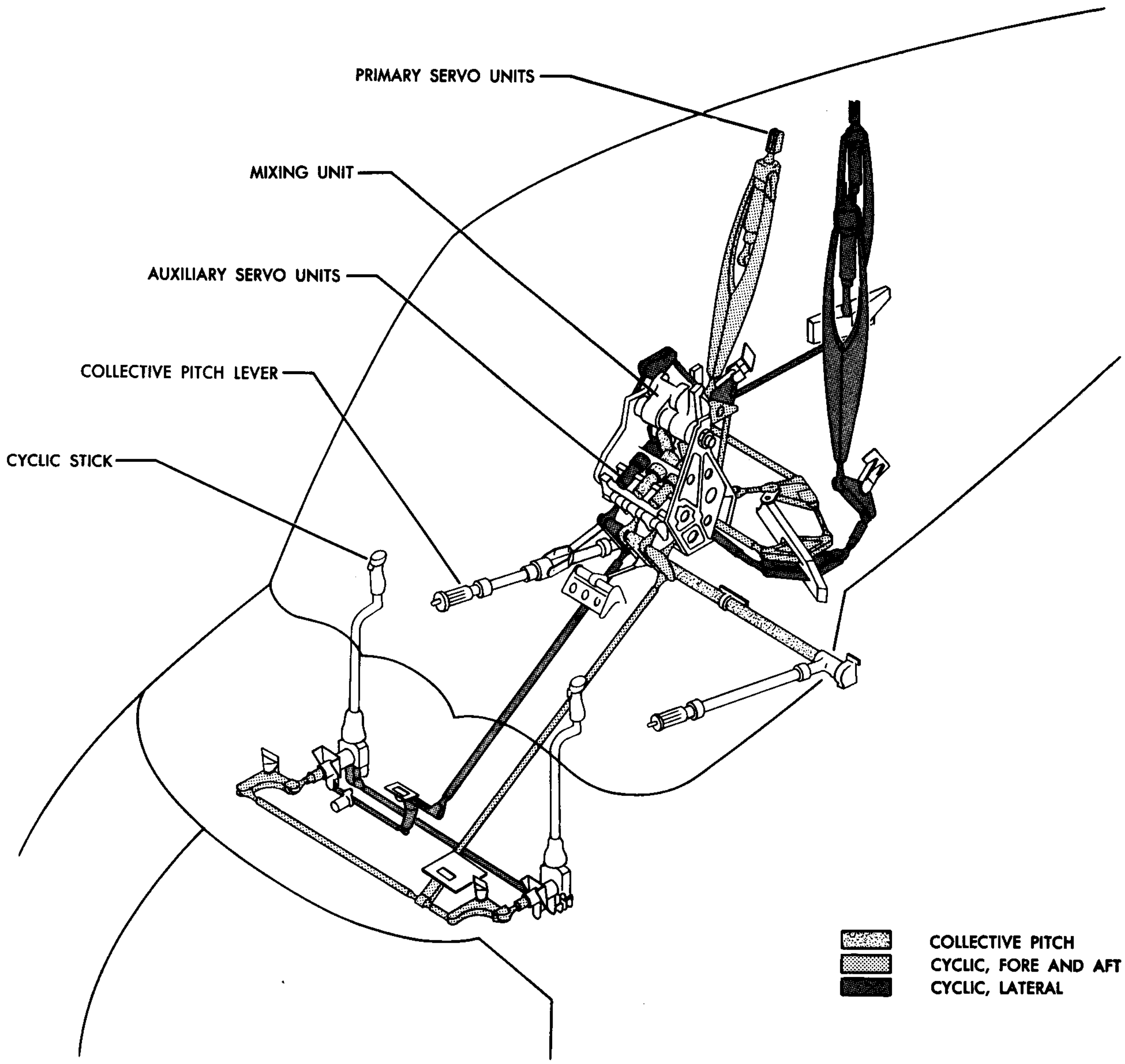


Figure 2–23. Main Rotor Flight Control System

circuits are located on the left-hand side of the panel.

2–133. AUTOTRANSFORMER FUSE PANEL. (See figure 2–22.) A panel containing a fuse and a spare fuse for the autotransformer that reduces 115-volt ac inverter output to 26 volts for operation of all electrical pressure gages is located on the structure above the inverters in the electronics compartment on Model CH-34A serial No. prior to 56–4313.

2–134. On helicopters serial No. 56–4313 and subsequent and on Model CH-34C, a panel containing a fuse and a spare fuse for the autotransformer is located in the battery compartment.

2–135. FLIGHT CONTROL SYSTEM.

2–136. The flight control system is divided into three systems: the main rotor flight control system, the tail rotor flight control system, and the flight control servo system.

2–137. MAIN ROTOR FLIGHT CONTROL SYSTEM. (See figure 2–23.)

2–138. The main rotor flight control system provides both vertical control and directional control.

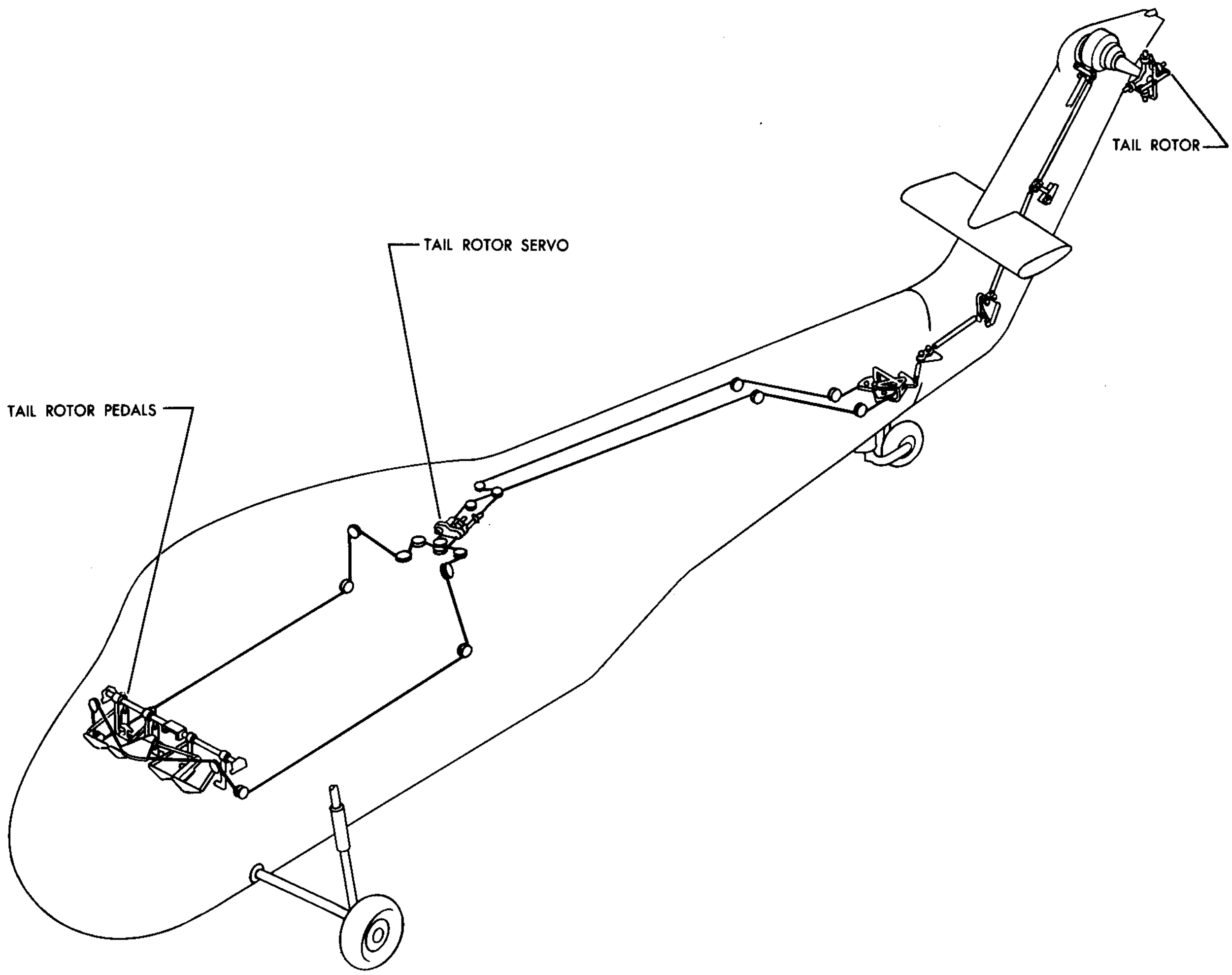


Figure 2–24. Tail Rotor Flight Control System

Vertical control is accomplished by changing the collective pitch of the main rotor blades to increase or decrease the angle of attack and consequently the lift developed by the blades. Directional control is accomplished by changing the pitch of each blade individually as it rotates. The change in pitch causes the blades to rise and fall as they rotate through 360 degrees, tilting the tip-path plane of rotation of the main rotor blades, thereby obtaining a horizontal, as well as a vertical, component of thrust. The horizontal component of thrust moves the helicopter horizontally in the direction the tip-path plane of rotation is tilted. Control motions from the collective pitch lever for vertical control, and from the cyclic stick for directional control, are combined in a mixing unit, located on the pilots' compartment bulkhead, and are transmitted to the main rotor assembly by mechanical linkage. Control action is assisted by two hydraulically operated flight control servo systems. The main rotor flight controls terminate at the stationary star of the main rotor assembly. Control action is transmitted from the stationary star through the rotating star and linkage on the rotor hub to the main rotor blades.

2–139. TAIL ROTOR FLIGHT CONTROL SYSTEM. (See figure 2–24.)

2–140. The functions of the tail rotor flight control system are to compensate for main rotor torque and to provide the means for changing the heading of the helicopter. The torque developed by the main rotor blades turning counterclockwise tends to rotate the fuselage in a clockwise direction. Gross weight, altitude, rate of climb and speed, and the corresponding power settings will vary the amount of main rotor torque. To compensate for torque variations, the pitch and resulting

thrust of the tail rotor blades can be increased or decreased. Turns are accomplished by increasing tail rotor thrust which overcompensates for main rotor torque and changes heading to the left, or by decreasing the tail rotor thrust which undercompensates for main rotor torque and changes the heading to the right. Tail rotor pedal movements are transmitted to the tail rotor assembly by mechanical linkage and cables. Control action is assisted by an auxiliary servo system. A hydraulic dampening device, incorporated in the control linkage, prevents abrupt movements of the tail rotor pedals which would cause sudden changes in thrust developed by the tail rotor and possible damage to the helicopter.

2–141. FLIGHT CONTROL SERVO SYSTEM. (See figure 2–25.)

2–142. Two servo hydraulic systems, the primary and the auxiliary, are incorporated into the flight control system. The servo systems provide a a power boost that greatly reduces the force required by the pilot to operate the controls. The servos also prevent feedback of the main rotor vibratory loads to the control sticks. Both servo systems operate from independent hydraulic systems and both utilize similar servo hydraulic piston units to vary the pitch of the main rotor blades through the mechanical linkage of the main rotor flight control system. The auxiliary servo system has an additional servo unit connected to the mechanical linkage of the tail rotor flight control system. Each servo unit consists of a power piston with a pilot valve parallel to it in the same housing. The flight control system actuates the pilot valves which control the flow of hydraulic oil to the power pistons. Each power piston is connected back to the flight control linkage to provide the power boost. The continuity of the direct control linkage is maintained from the controls in the pilots' compartment through the primary and auxiliary servos, to the rotor blades, except for a slight amount of end play at each servo unit to permit actuation of the pilot valves. Normally, both servo systems are in operation at all times. For hydraulic oil specification, see figure 2–29.

2–143. PRIMARY FLIGHT CONTROL SERVO HYDRAULIC SYSTEM. (See figure 2–25.) The primary servo hydraulic system consists of three main rotor primary servo units which connect the flight control linkage to the stationary star of the main rotor assembly. The servos assist the pilot in the operation of the main rotor flight control system only. The primary servo hydraulic pump is driven by the main gear box and functions when the main rotor is turning. The primary servo hydraulic reservoir (5, figure 2–29), mounted on the left-hand side of the main gear box, has a capacity of approximately 2-1/2 quarts of hydraulic oil. A push-button switch, located on the forward bulkhead of the transmission compartment, controls a light to aid in checking the oil level sight gage located in the reservoir. An inspection window, located on the bulkhead behind the copilot's head, allows inspection of the sight gage while in flight.

2–144. AUXILIARY FLIGHT CONTROL SERVO HYDRAULIC SYSTEM. (See figure 2–25.) The auxiliary servo hydraulic system consists of a bank of three main rotor auxiliary servo units mounted forward of the main rotor flight control system mixing unit on the pilots' compartment bulkhead and a tail rotor servo unit connected to the tail rotor flight control cables aft of the main gear box. The auxiliary servo system assists in the operation of the main and tail rotor flight control systems and provides a standby servo in case of failure of the primary servo system. The auxiliary servo hydraulic pump is driven by the engine. The auxiliary servo hydraulic reservoir (9, figure 2–29), located in the left-hand side of the clutch compartment, has a capacity of approximately 2-1/2 quarts of hydraulic oil. A push-button switch, located in the cabin on the forward wall, controls a light to aid in inspecting the reservoir oil level sight gage.

2–145. On helicopters serial No. 56–4313 and subsequent and on Model CH-34C, the auxiliary servo hydraulic reservoir (14, figure 2–29) is located on the right-hand side of the transmission deck, thus permitting easy inspection and servicing of the hydraulic reservoir.

2–146. FLIGHT CONTROL SERVO SWITCH. (See figure 2–26.) The three-position flight control servo switch controls the primary and auxiliary servo systems, and is located on a control box at the end of the pilot's collective pitch lever. The switch is marked SERVO with positions PRI. OFF, ON, and AUX. OFF. Both servo systems are normally in operation with the switch in the ON position. To turn off the primary servos, the switch is placed in the PRI OFF position; and to turn off the auxiliary servos, the switch is placed in the AUX. OFF position. Stronger tail rotor pedal forces

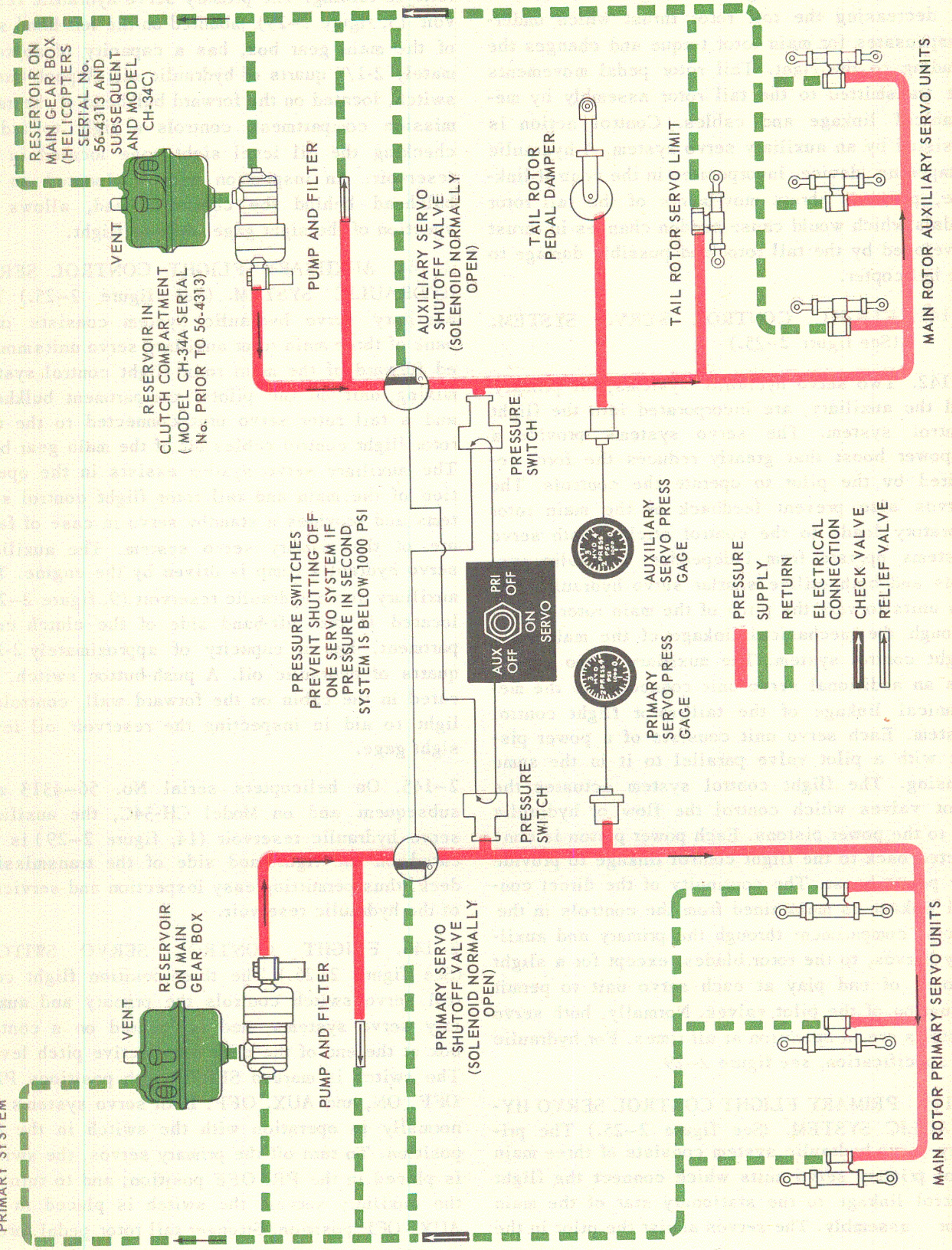


Figure 2-25. Servo Hydraulic System

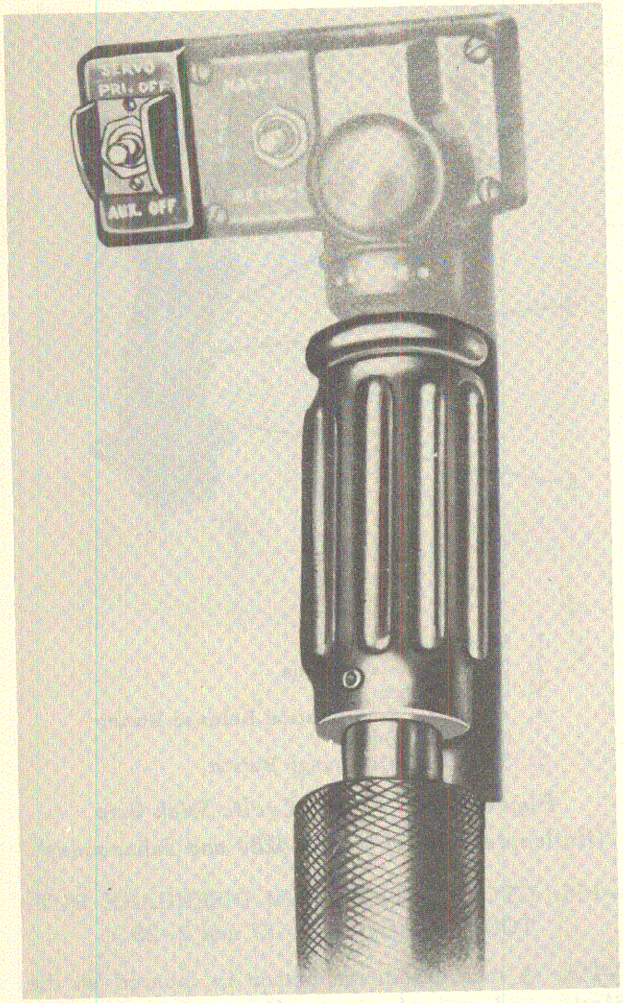


Figure 2-26. Flight Control Servo Switch

will be encountered with the auxiliary servos inoperative. The systems are connected electrically by pressure switches which prevent shutting off of either system unless there is at least a pressure of 1000 psi in the remaining system. The servo shutoff valves operate on direct current from the primary bus and are protected by a circuit breaker, marked SERVO, located on the overhead circuit panel. If either servo system malfunctions the malfunctioning system may be turned off and the helicopter flown on the other servo system.

2–147. FLIGHT CONTROL SERVO HYDRAULIC PRESSURE GAGES. (See figures 2–10 and 2–11.) Two servo system hydraulic pressure gages (28 and 31, figure 2–10 and 33 and 35, figure 2–11) are located on the instrument panel. The gages operate on alternating current. The left-hand gage indicates the pressure in the primary servo system; the right-hand gage indicates the pressure in the auxiliary servo system.

2–148. COLLECTIVE PITCH LEVER. (See figure 2–7.)

2–149. Two collective pitch levers are located in the pilots' compartment, one to the left of the pilot's seat and the other to the left of the copilot's seat. Both controls operate simultaneously to change the collective pitch of the main rotor blades. A collective pitch lever lock nut (1) on the pilot's collective pitch lever can be rotated to apply friction to the control or to prevent the collective pitch from creeping while in flight. STICK LOCK FRICTION and a directional arrow for increasing friction are marked on the lock. The rotatable grip of each collective pitch lever is a throttle (3) which is partially synchronized to the vertical movement of the collective pitch lever as described in paragraph 2–9. The engine starter button (5) and a landing light control box (4) are located on the end of the pilot's collective pitch lever.

2–150. CYCLIC STICK. (See figure 2–4.)

2–151. A cyclic stick (1 and 6) in front of each seat in the pilots' compartment provides directional control of the helicopter. Moving the cyclic stick in any direction tilts the tip-path plane of rotation of the main rotor blades in that direction and moves the helicopter in the same direction. The cyclic stick grip (figure 2–27) of each cyclic stick also contains a two-position microphone switch, marked RADIO and I.C.S; a button, marked STICK TRIM; and a button, marked CARGO.

2–152. On helicopters serial No. 56–4284 and subsequent, modified cyclic stick grips (figure 2–28) are installed. The cyclic stick grips contain a hoist switch (3), marked HOIST, with positions UP and DOWN; a cargo release button (2), marked CARGO; a stick trim disengage button (5), marked TRIM REL; a two-position microphone switch (2) with marked positions RADIO and INT, and a button (4) marked AUTO STAB RELEASE.

2–153. CYCLIC STICK TRIM SWITCH. (See figure 2–20.)

2–154. A cyclic stick trim switch is located on the overhead switch panel. The switch has two positions marked STICK TRIM OFF and ON TRIM. This switch is the master switch for the force gradient stick trim system and controls the opera-

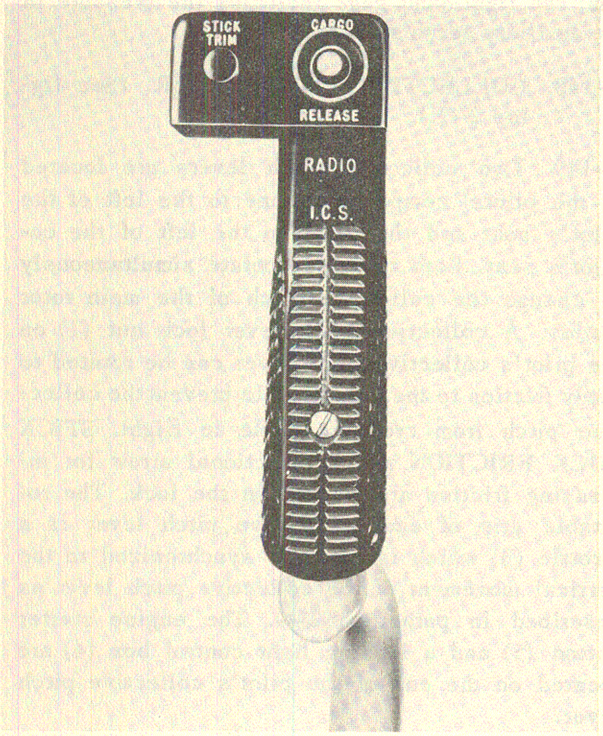
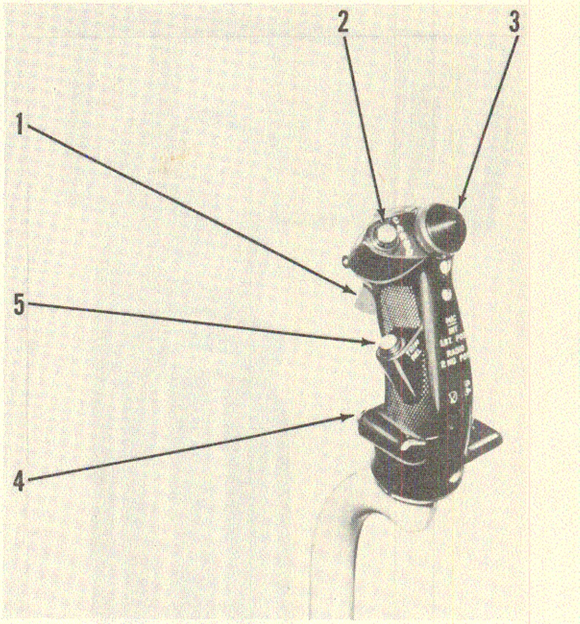


Figure 2-27. Pilot's Cyclic Stick Grip (Model CH-34A, Serial No. Prior to 56-4284)



1. Microphone Switch
2. Cargo Release Button
3. Hoist Switch
4. Automatic Stabilization Release Button (Model CH-34C)
5. Stick Trim Disengage Button

Figure 2-28. Pilot's Cyclic Stick Grip (Helicopters Serial No. 56-4284 and Subsequent)

tion of magnetic brakes and spring cylinders connected to the linkage of the cyclic stick below the floor of the pilots' compartment. The system operates on direct current from the secondary bus. When the switch is placed in the ON TRIM position, the system is deenergized and arms on the magnetic brakes are held in position. The spring cylinders connected to the magnetic brake arms set up an initial resistant force of 2 pounds to hold the stick in position. This initial force increases in proportion to the distance the cyclic stick is displaced from the initial position. This provides the pilot with a means of "feel" in his movements of the cyclic stick as forces will always be set up to return the cyclic stick to its initial position. When the switch is placed in the STICK TRIM OFF position, solenoids energize the magnetic brakes and the arms are free to move. This releases the force gradient stick trim system resulting in a loss of cyclic stick "feel." Flight with the stick trim system in the off position is permissible; however, inadvertent release of the cyclic stick could result in an unsafe attitude as the stick, when released, will fall away and hit the control stops.

2-155. CYCLIC STICK TRIM DISENGAGE BUTTON. (See figures 2-27 and 2-28.)

2-156. A trim disengage button is located on the pilot's and copilot's cyclic stick grips (figure 2-27). The button is marked STICK TRIM and enables the pilot or copilot to trim the cyclic stick to any desired position. When it is desired to reposition the cyclic stick to change the attitude of the helicopter, the button is depressed and the cyclic stick is moved to the desired position. Pressing the button energizes the magnetic brakes and the arms will move to the new location. Trim will then be set up about the new position. If the button is not depressed before moving the cyclic stick to a new position, the cyclic stick will "jump" because of the almost instantaneous reduction in the force opposing the force exterted by the pilot on the cyclic stick. On Model CH-34A helicopters serial No. 56-4284 and subsequent, and Model CH-34C, the stick trim disengage button is located at the left side of the cyclic stick grip (5, figure 2-28) below the cargo release button. The button is marked TRIM REL. It enables the pilot

or copilot to trim the cyclic stick to the desired position.

2–157. TAIL ROTOR PEDALS. (See figure 2–4.)

2–158. The tail rotor pedals (10 and 18), one set in front of the pilot and the other in front of the copilot, change the pitch and thrust of the tail rotor, and consequently the heading of the helicopter. Pressing the left pedal increases the tail rotor blade pitch which increases thrust and heads the helicopter to the left. Pressing the right pedal decreases tail rotor blade pitch which decreases thrust and heads the helicopter to the right. Tail rotor pedal adjustment knobs (11 and 19), to adjust the pedals for leg length, are located below the instrument panel. Brake pedals (9) for the main landing gear wheel brakes are mounted on the pilot's tail rotor pedals.

2–159. LANDING GEAR SYSTEM. (See figure 2–2.)

2–160. The landing gear system consists of a fixed main landing gear (18) and a tail wheel (28). The main landing gear consists of two wheels which are attached to the forward section of the fuselage by oleo shock struts. The main wheels are equipped with hydraulic brakes. The tail wheel, located underneath the tail cone, is full-swiveling and self-centering and may be locked in the center position.

2–161. TAIL WHEEL LOCK HANDLE. (See figure 2–4.)

2-162. A tail wheel lock handle (12) is located below the instrument panel in front of the pilot's seat. The handle is marked TAILWHEEL LOCK – PULL TO LOCK. Pulling the handle out permits a spring-loaded lockpin to engage at the swivel joint after the tail wheel is centered. Pushing the handle in releases the lock and allows the tailwheel to swivel. A button in the center of the handle must be pressed in to release a ratchet-type lock before the tail wheel can be unlocked. The tail wheel should only be locked for straight takeoffs and landings. During maneuvers on the ground the tail wheel should be unlocked to reduce strain on the pylon and the possibility of shearing the tail wheel lockpin. If any side loads are imposed on the tail wheel, the lockpin will not engage.

2–163. TAIL WHEEL LOCK FLAG INDICATOR.

2–164. A flag is installed in the center of the tail wheel yoke assembly to enable maintenance personnel to check that the tail wheel is unlocked before attempting to tow the helicopter. The flag is marked PIN LOCKED. When the tail wheel is locked, the flag extends upward and is visible between the yoke assembly and the bottom of the fuselage. When the tail wheel is unlocked, the flag retracts into the center of the yoke assembly.

2–165. BRAKE SYSTEM.

2–166. The main landing gear wheels are equipped with hydraulic brakes which are operated by the toe pedals mounted on the pilot's tail rotor pedals. The copilot's tail rotor pedals are not equipped with brake pedals. A parking brake handle locks the brakes when the helicopter is parked.

2–167. BRAKE PEDALS. (See figure 2–4.)

2–168. The main landing gear wheels are individually braked by depressing the corresponding toe brake pedal (9) mounted above the pilot's tail rotor pedals. The brakes operate on hydraulic pressure developed by the pilot in depressing the brake pedals.

2–169. PARKING BRAKE HANDLE. (See figure 2–4.)

2–170. The parking brake handle (14) is located below the instrument panel to the right of the pilot. The handle is marked PARKING BRAKE. The parking brake is applied by first depressing the toe brake pedals and then pulling out the parking brake handle and releasing the toe brake pedals. Pressing the brake pedals again will release the parking brake.

2–171. INSTRUMENTS.

2–172. Instruments operating on alternating current are protected by fuses, and instruments operating on direct current are protected by circuit breakers, located on the overhead circuit breaker and fuse panel (see figure 2–21). If the flight instrument inverter failure warning light should go on, instruments operating on alternating current will be inoperative until the flight instrument inverter switch is placed in the SPARE position.

2–173. PITOT-STATIC SYSTEM. (See figures 2–2, 2–10, and 2–11.)

2–174. A pitot tube (9, figure 2–2) is located over the sliding window of the pilots' compartment on the right-hand side of the helicopter. A static port (4) is located on top of the electronics compartment. Tubing connects the pitot tube to the airspeed indicator (3 and 16, figure 2–10 and 3 and 19, figure 2–11). Tubing connects the static port to the airspeed indicator, the vertical velocity indicator (15, figure 2–10 and 6 and 18, figure 2–11), and the altimeter (25, figure 2–10 and 29 and 40, figure 2–11).

2–175. STANDBY COMPASS. (See figures 2–5 and 2–6.)

2–176. A standby compass (6) is mounted in the center of the pilots' compartment above the windshield. A compass correction card is attached to the standby compass mounting bracket. The compass is lighted by the same circuit as the flight instruments and controlled by the same rheostat on the overhead switch panel.

2–177. FREE-AIR TEMPERATURE GAGE. (See figures 2–5 and 2–6.)

2–178. A bimetallic free-air temperature gage (5), calibrated in degrees centigrade, is located on the centerline of the helicopter in the glass panel above the standby compass.

2–179. TURN-AND-BANK INDICATOR. (See figures 2–10 and 2–11.)

2–180. The gyro of the turn-and-bank indicator (26, figure 2–10 and 30 and 41, figure 2–11) operated on direct current from the primary bus. The gyro is in operation when the primary bus is energized.

2–181. J-8 ATTITUDE INDICATOR.

2–182. The J-8 Attitude Indicator (14, figure 2–10 and 4, figure 2–11) shows the flight attitude for any angular displacement of the helicopter in relation to the earth's horizontal plane. The indicator may be manually caged by means of a knob, located at the lower right of the instrument. The knob is marked PULL TO CAGE. The indicator should be caged on the ground within the first minute after application of power. To cage the indicator, pull the knob smoothly away from the instrument. A momentary stop will be felt as the bank caging mechanism is engaged; pull the knob further until the pitch caging mechanism operates. When the knob reaches the limit of its travel, it should be released and returned without binding. The indicator may also be caged if erratic behavior is observed after prolonged turns in which accumulated effects of centrifugal force have been sensed as gravitational forces by the indicator. Caging should be attempted only if the pilot has a visual horizon reference, as the instrument cages to the attitude of the helicopter and not to true vertical. The knob at the left side of the attitude indicator is used to raise or lower the attitude bar to line it up with the horizon bar in straight and level flight. The attitude indicator is equipped with a warning flag, marked OFF, to warn the pilot when the indicator is not receiving operating power. The indicator operates on current from the 115-volt alternating current bus.

WARNING

A slight amount of pitch error in indication of type J-8 Attitude Indicator will result from accelerations or decelerations. It will appear as a slight climb indication after a forward acceleration, and as a slight dive indication after deceleration when helicopter is flying straight and level. This error will be most noticeable when helicopter breaks ground during takeoff run. At this time, a climb indication error of about 1-1/2 bar widths will normally be noticed; however, exact amount of error will depend upon acceleration and elapsed time of each individual takeoff. Erection system will automatically remove the error after acceleration ceases.

CAUTION

An error in helicopter attitude of up to 5 degrees may be introduced in J-8 attitude indicator when normal turns are performed.

Caging knob of J-8 Attitude Indicator should not be pulled violently as it may damage instrument.

Caging of J-8 Attitude Indicator should be kept to a minimum and never accomplished in flight, except when helicopter is in straight and level flight.

2–183. B-1A ATTITUDE INDICATOR. (See figure 2–11.)

2–184. On helicopters Serial No. 57–1742 and subsequent, one B-1A Attitude Indicator (15) is installed on the pilot's side of the instrument panel. The attitude indicator provides a constant visual indication of the attitude of the helicopter relative to the earth's horizon. The position of an attitude bar with respect to the horizon bar indicates the attitude of the helicopter in pitch and roll. When the pitch of the helicopter exceeds a 27-degree nose-high attitude, the word CLIMB appears on the lower part of the sphere within the indicator, and when the pitch exceeds a 27-degree nose-down attitude, the word DIVE appears on the upper part of the sphere. A pitch trim knob at the lower right corner of the instrument positions the horizon bar. The top of the instrument has a bank reference scale to show both right and left bank, and a pointer attached to the gyro indicates the angle of bank. Placing the battery switch in the BATT position will energize the gyro. Ten minutes is required for the gyro to erect for an accurate reading. The B-1A Attitude Indicator operates on 115-volt alternating current and 28-volt direct current received simultaneously. The indicator is protected by a circuit breaker, marked B-1A GYRO, located on the overhead circuit breaker and fuse panel (figure 2–21), and a fuse, marked B-1A GYRO, located on the pilots' compartment dome light panel (figure 3–4, Chapter 6.) A warning flag, marked OFF, is visible through the cover of the indicator when power is cut off, and remains visible for 2 minutes after power is applied. The warning flag will appear in case of a complete ac or dc power failure. However, a slight reduction in ac or dc power or failure of certain electrical components within the system will not cause the warning flag to appear, even though the the system is not functioning properly.

WARNING

It is possible that a malfunction of attitude indicator might be determined only by checking it with directional indicator (gyro-magnetic compass) and turn-and-bank indicator.

2–185. There is no manual caging device. When power is turned off, the gyro gimbal is supported, and when power is applied, the gimbal is released.

WARNING

A slight amount of pitch error in indication of B-1A Attitude Indicator will result from accelerations or decelerations. It will appear as a slight climb indication after forward acceleration and as a slight dive indication after deceleration when helicopter is flying straight and and level. This error will be most noticeable when helicopter breaks ground during takeoff run. At this time, a climb indication error of about 1-1/2 bar widths will normally be noticed; however, exact amount of error will depend upon acceleration and elapsed time of each individual takeoff. Erection system will automatically remove error after acceleration ceases.

2–186. DIRECTIONAL INDICATOR. (See figures 2–10 and 2–11.)

2–187. The J-2 Gyro-Magnetic Compass system provides stabilized compass indications by combining the advantages of the remote indicating magnetic compass with the gyro compass. The oscillations of the magnetic compass and the drift error of the directional gyro are eliminated when operating as a directional indicator and an accurate stabilized magnetic heading is indicated. In magnetically unreliable regions, such as encountered in high latitudes, the gyro may be unslaved from the compass system to act as a free directional gyro. The system consists of a magnetic flux valve located in the tail cone, a directional gyro and amplifier located in the electronics compartment, and a directional indicator (12, figure 2–10 and 5 and 17, figure 2–11) on the instrument panel. A set course knob on the lower left of the indicator rotates the dial face in order to align the selected heading with the indices of the instrument. The system operates on direct current from the primary bus and alternating current from the 115-volt ac bus. An interlock relay assures that both ac and dc reach the system at the same time.

2–188. DIRECTIONAL INDICATOR COMPASS SLAVING SWITCH. A switch (13, figure 2–10 and 16, figure 2–11) is located on the instrument panel to the right of the pilot's altimeter. The switch is marked COMPASS SLAVING and has two marked positions, IN and OUT. When the switch is placed in the IN position, the system operates as a gyro-

magnetic compass and the pointer will indicate an accurate stabilized magnetic heading. When the switch is placed in the CUT position, the system operates as a free directional gyro and may be used as a turn indicator. When the compass slaving switch is in the IN position, the system utilized both 28 volts dc from the primary bus and alternating current from the 115-volt ac bus.

2–189. When the compass slaving switch is in the OUT position, the system utilizes only 28 volts dc from the primary bus.

2–190. EMERGENCY EQUIPMENT.

2–191. ENGINE FIRE DETECTOR SYSTEM. (See figure 2–16.)

2–192. A closed series loop fire detector system is installed in the engine compartment. Three sensing elements, one on each engine compartment access door and one beside the engine oil cooler, are connected to a relay control unit which turns on a warning light on the main switch panel in the pilots' compartment in the event of an abnormal temperature rise in the engine compartment. The fire detector system operates on alternating current.

2–193. FIRE DETECTOR WARNING LIGHT AND TEST SWITCH. (See figure 2–16.) An engine fire detector warning light and test switch are installed on the main switch panel on the left side of the instrument panel. The warning light and test switch are marked FIRE DET. The red light is marked WARN and will light in the event of fire in the engine section. The switch is of the momentary-on type. To test the engine fire detector system, the switch is held in the spring-loaded TEST position. The fire warning light should go on and then off when the switch is released. The fire detector warning light and test switch utilizes dc from the primary bus and is protected by a circuit breaker, marked FIRE DETECTOR, located on the overhead circuit breaker panel.

2–194. PORTABLE FIRE EXTINGUISHER. (See figure 5–2, Chapter 4.)

2–195. A hand-operated portable monobromotrifluoromethane (CF_3Br) fire extinguisher (4) is installed in the cabin on the right side forward of the cabin door.

WARNING

Monobromotrifluoromethane (CF_3Br) is very volatile, but is not easily detected by its odor. Although nontoxic, it must be considered to be about the same as other freons and carbon dioxide, causing danger to personnel primarily by reduction of oxygen available for proper breathing. During operation of the portable fire extinguisher, ventilate personnel areas with fresh air. The liquid should not be allowed to come into contact with the skin, as it may cause frostbite or low temperature burns because of its very low boiling point.

2–196. ALARM BELL. (See figure 5–2, Chapter 4.)

2–197. An alarm bell (1) is located in the cabin of the helicopter. The alarm bell is operated from the pilot's compartment by a switch, located under a guard on the overhead switch panel.

2–198. ALARM BELL SWITCH. (See figure 2–20.) The alarm bell switch is located on the overhead switch panel. The switch is marked CREW ALARM. When the switch is moved to the ON position, the alarm bell operates on direct current from the primary bus.

2–199. FIRST AID KITS. (See figure 5–2, Chapter 4.)

2–200. Two first aid kits (2) are mounted on the left and right sides of the cabin aft bulkhead. A third first aid kit (3) is installed in the pilots' compartment between the pilot and the copilot.

2–201. EMERGENCY EXITS. (See figure 5–1, Chapter 4.)

2–202. PILOTS' COMPARTMENT EMERGENCY EXITS.

2–203. The sliding windows on each side of the pilots' compartment can be jettisoned from any position, from open to closed, to provide emergency exits. The windows are jettisoned by pulling back on the release handles (2), which are located at the forward upper corner of the windows inside the compartment. The release handles are marked EMERGENCY EXIT-PULL. The windows can also be released from the outside by pulling out on the handles (1) which are located at the forward upper corner of the window.

2-204. CABIN EMERGENCY HATCHES.

2-205. The two panels which contain the two windows on the left side of the cabin may be jettisoned to provide cabin emergency exits. The emergency release handles (7) are located at the lower aft corner of each panel. The handles are marked EMERGENCY EXIT-TURN. To jettison an emergency hatch, the handle is turned in the direction of the arrow and the hatch pushed out. Handles are also provided to open the hatches from outside the helicopter. The outside handle (8) should be turned clockwise and the hatch pulled out.

2-206. CABIN DOOR EMERGENCY EXIT.

2-207. The cabin door can be jettisoned to provide an additional cabin emergency exit by pulling down on a handle (3) which is located in the forward upper corner of the door. The handle is marked EMERGENCY EXIT-TURN. A similar handle (4) is located on the outside of the door.

2-208. CABIN DOOR WINDOW EMERGENCY EXIT.

2-209. The window (6) in the cabin door can be pushed out to provide an emergency exit in case the cabin door cannot be jettisoned. Below the window on the cabin door is marked EMERGENCY EXIT PUSH OUT WINDOW. On the outside of the cabin door, (5) the window is marked CUT FOR EMERGENCY RESCUE, and is removed by cutting along the yellow guide marks in the four corners.

2-210. CABIN WINDOW EMERGENCY EXIT.

2-211. The cabin window (9) is located on the aft right-hand side of the cabin compartment wall. The cabin window is marked EMERGENCY EXIT PUSH OUT WINDOW and may be pushed out to provide an additional emergency exit. On the outside the cabin window is equipped with a pull tab (10) at the lower aft corner. The pull tab is marked PULL TAB EXIT RELEASE, by which the locking strip may be released from the rubber seal surrounding the window pane. The pane will then fall out and provide an emergency opening. Before exit or entrance can be made through this opening, the troop seat back support bar must be pulled from its friction lock in front of the window. Because of its small size the window is not suitable for bailout.

2-212. PILOT'S AND COPILOT'S SEATS.

2-213. The pilot's and copilot's seats are located side-by-side in the pilots' compartment. The bottom pans of the seats fold upward to permit access to the pilots' compartment from the cabin. The seats are designed to accommodate back-type parachutes and pararafts. Both seats have a 4-1/2 inch range-of-height adjustment and are equipped with safety belts and shoulder harnesses. The seats are also equipped with seat and back cushions. Safety belt stowage hooks are provided on each seat back for stowing the safety belts when a seat is not occupied. The belts are stowed by fastening the belt and hooking it to the stowage hook. Stowing the safety belts in this manner will prevent the possibility of the belt becoming jammed between the collective pitch lever and the seat.

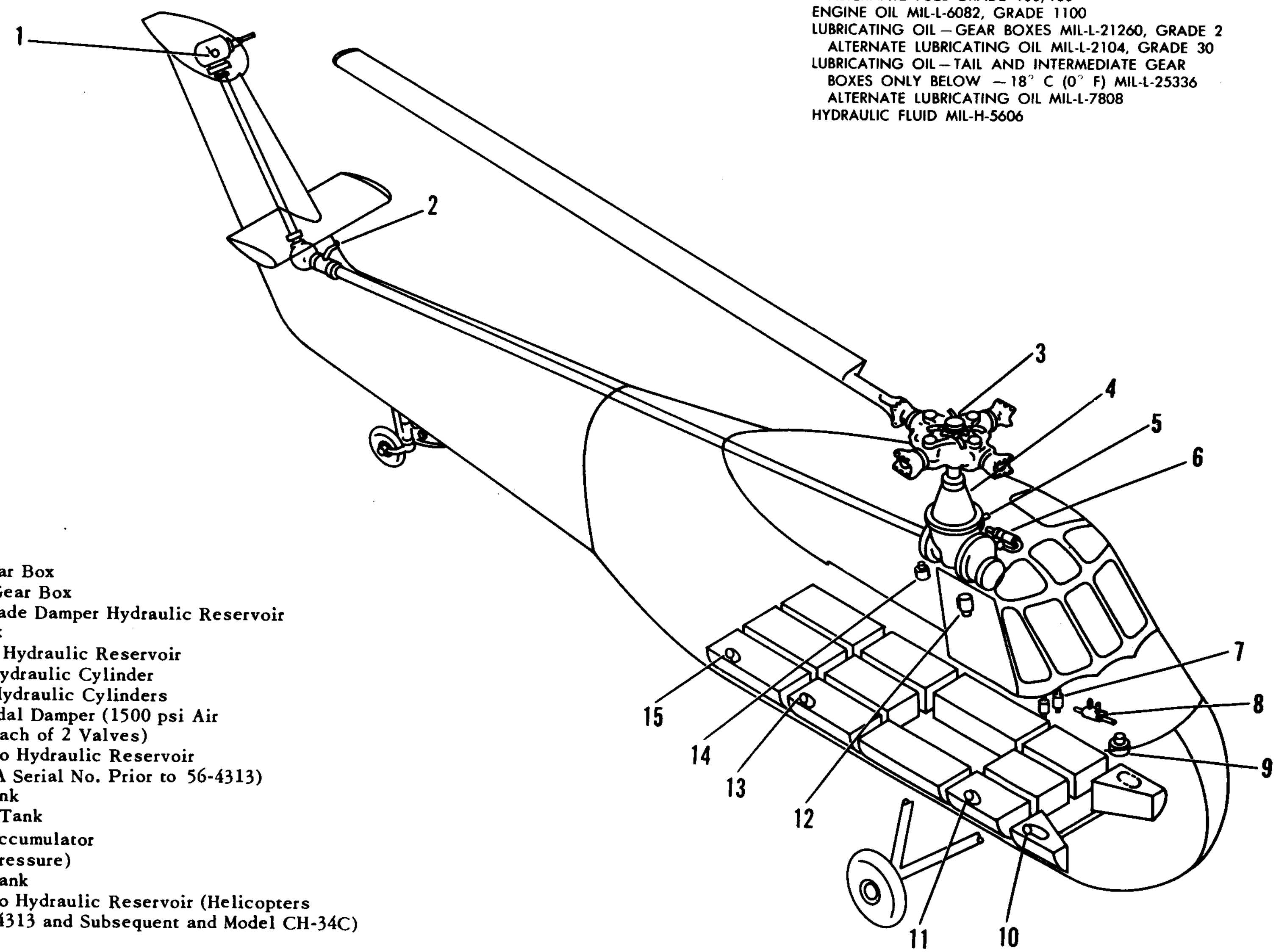
2-214. SEAT HEIGHT ADJUSTMENT LEVER.

2-215. A lever at the right side of the pilot's seat is pulled up to release the seat lockpins. A similar lever is located on the right of the copilot's seat. The seats aided by spring-loaded bungees can then be adjusted for height by varying the weight upon them. The lockpins will automatically engage in any of five positions.

2-216. SHOULDER HARNESS INERTIA REEL LOCK LEVER. (See figure 2-4.)

2-217. A two-position shoulder harness inertia reel lock lever (17) is located at the left side of each seat. By pressing down on the top of the lever, a latch is released and the lever may be moved from one position to the other. When the lever is in the UNLOCKED (aft) position, the shoulder harness cable will extend to allow the occupant to lean forward; however, the cable reel will automatically lock if an impact force of two or three G's is encountered. When this occurs, the cable reel will remain locked until the lever is moved to the LOCKED position and then returned to the UNLOCKED position. When the lever is placed in the LOCKED (forward) position, the shoulder harness cable is locked so that the occupant is prevented from leaning forward. The LOCKED position is used only when a crash landing or ditching is anticipated, to provide an added safety precaution over that of the automatic lock.

FUEL MIL-G-5572, GRADE 115/145
ALTERNATE FUEL GRADE 100/130
ENGINE OIL MIL-L-6082, GRADE 1100
LUBRICATING OIL — GEAR BOXES MIL-L-21260, GRADE 2
ALTERNATE LUBRICATING OIL MIL-L-2104, GRADE 30
LUBRICATING OIL — TAIL AND INTERMEDIATE GEAR
BOXES ONLY BELOW — 18° C (0° F) MIL-L-25336
ALTERNATE LUBRICATING OIL MIL-L-7808
HYDRAULIC FLUID MIL-H-5606



1. Tail Rotor Gear Box
2. Intermediate Gear Box
3. Main Rotor Blade Damper Hydraulic Reservoir
4. Main Gear Box
5. Primary Servo Hydraulic Reservoir
6. Rotor Brake Hydraulic Cylinder
7. Wheel Brake Hydraulic Cylinders
8. Tail Rotor Pedal Damper (1500 psi Air Pressure At Each of 2 Valves)
9. Auxiliary Servo Hydraulic Reservoir (Model CH-34A Serial No. Prior to 56-4313)
10. Engine Oil Tank
11. Forward Fuel Tank
12. Rotor Brake Accumulator (250 psi Air Pressure)
13. Center Fuel Tank
14. Auxiliary Servo Hydraulic Reservoir (Helicopters Serial No. 56-4313 and Subsequent and Model CH-34C)
15. Aft Fuel Tank

Figure 2–29. Servicing Diagram

2-218. PILOTS' COMPARTMENT LADDERS.

(See figure 2-3.)

2-219. Two pilots' compartment ladders (24) on the forward bulkhead of the cabin may be used to enter or leave the pilots' compartment. The ladders extend upward from the cabin to below the folding seat pans of the pilot's and copilot's seats.

CAUTION

Care should be taken when using pilots' compartment ladders during flight, as clothing or parachutes may foul flight controls.

2-220. AUXILIARY EQUIPMENT.

2-221. The following items are covered in Chapter 6.

a. Heating System

b. Ventilating System

c. Pitot Heater

d. Lighting Equipment

e. Cargo Carrying Equipment

f. Rescue Hoist

g. Troop Carrying Equipment

h. Casualty Carrying Equipment

i. Miscellaneous Equipment

j. Pylon and Main Rotor Blade Folding

2-222. DESTRUCTION OF HELICOPTER.

2-223. If there is a possibility of the helicopter falling into the hands of the enemy after abandonment, destroy the helicopter sufficiently to deny use or technical intelligence to the enemy. There is no set procedure for destroying the helicopter; however, a method to follow is:

a. Open fuel drain valve, puncture a fuel cell, or break a fuel line.

b. From a safe distance, ignite fuel.

Note

Fuel may possibly be ignited from a safe distance by firing flares into dripping fuel.

CHAPTER 3
NORMAL PROCEDURES
SECTION I
SCOPE

1–1. GENERAL.

1–2. This chapter deals with the many procedures required to insure safe and efficient operation of the helicopter. Steps are included in checklist form covering the flight from the time it is planned until it is completed and the helicopter is left properly parked and secure.

1–3. The flight envisioned in this chapter is of a nontactical nature and is considered to be accomplished under normal conditions. The checklists include all steps necessary to insure safe flight under all conditions (night, instrument, etc).

1–4. The unique "feel" characteristics and the reaction of the helicopter during specific phases of operation are also included in this chapter, along with the technique to be employed in accomplishing such operations as taxiing, takeoff, climb, etc.

SECTION II
CHECKS

2-1. CHECKLISTS.

2-2. The checklists used by the pilots include the amplified normal and emergency procedures and the normal and emergency procedures in condensed form. The amplified normal and emergency procedures are contained in Chapters 3 and 4, respectively, and include all explanatory material, notes, cautions, and warnings. The condensed versions of the normal and emergency procedures are issued as a separate publication. (Refer to Appendix IV.) The amplified and condensed procedures follow the same check numbers although the condensed procedures omit all explanatory text with the exception of an occasional note, caution, or warning.

2-3. The takeoff and landing checklist placard (figure 2-1) is mounted on the pilot's instrument panel. This placard provides a visible procedure to be followed when taking off or landing the helicopter.

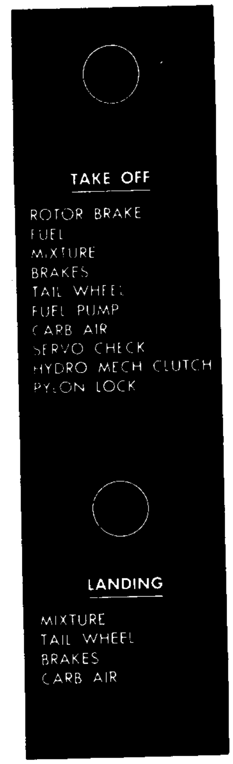


Figure 2-1. Checklist

2-4. PREPARATION FOR FLIGHT.

2-5. Prior to flight, the pilot should assure that all information in this manual that is applicable to the proposed mission is complied with.

2-6. FLIGHT RESTRICTIONS.

2-7. For limitations imposed on the helicopter, refer to Chapter 7.

2-8. FLIGHT PLANNING.

2-9. The required fuel, airspeed, and power settings for takeoff, climb, cruising, hovering, and landing may be determined by reference to the performance data tables and charts in Chapter 14.

2-10. TAKEOFF AND LANDING DATA CARD.

2-11. For a discussion of the takeoff and landing data card, and the proper means of filling it out, refer to paragraph 2-39, Chapter 14.

2-12. WEIGHT AND BALANCE.

2-13. With improper loading, it is possible to exceed the cg limits of this helicopter. The takeoff gross weight and balance, and the anticipated landing gross weight and balance should be determined before takeoff and checked against the weight limitations and center-of-gravity limitations. (Refer to paragraphs 2-37 and 2-39, Chapter 7.) Reference should be made to Chapter 12 and to DD Form 365F for loading information.

2-14. ENTRANCE. (See figure 2-2.)

2-15. Entrance to the cabin is through the sliding door on the right side of the helicopter. The pilots' compartment may be entered from the cabin by pushing upward on the hinged bottoms of the pilot's and copilot's seats and climbing the ladders on the cabin forward bulkhead. The pilots' compartment may also be entered from outside by climbing up the sides of the fuselage, using handgrips and foot wells, and entering through the sliding windows.

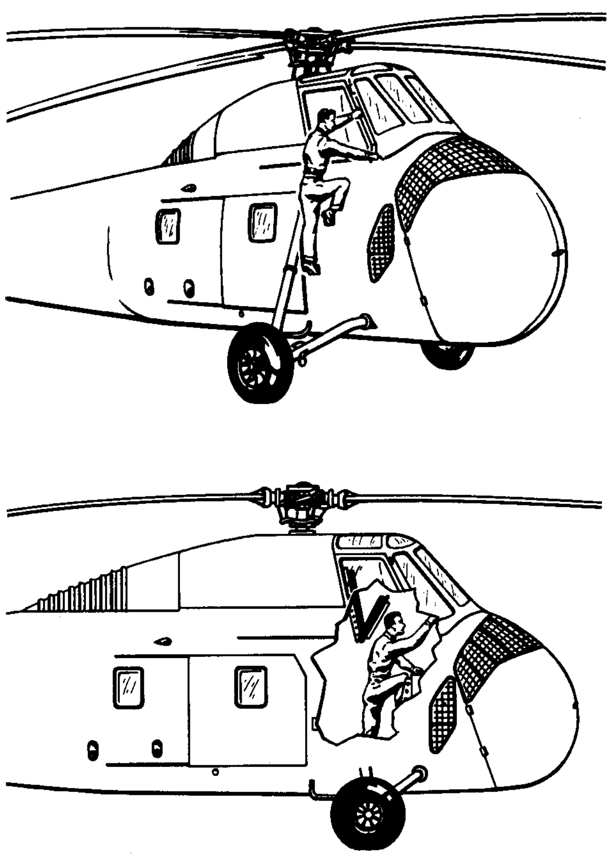


Figure 2–2. Entrances to Helicopter

CAUTION

Care should be taken to use only handgrips provided when entering pilots' compartment.

2–16. PREFLIGHT CHECK.

2–17. BEFORE EXTERIOR CHECK.

a. DA Form 2408 – CHECK.

b. DD Form 365F – CHECK.

c. Ignition switch – OFF.

d. Battery switch – OFF.

e. Fuel flow selector valve handle – OFF.

2–18. EXTERIOR CHECK. (See figure 2–3.)

a. RIGHT FRONT OF FUSELAGE.

(1) Landing gear oleo strut – CHECK CONDITION. Check for damage, leaks, and proper extension.

(2) Tire – CHECK. Check for slippage marks, proper inflation, and cracks.

(3) Forward fuel tank – CHECK SERVICING. Check fuel for proper servicing and cap secure.

(4) Oil tank – CHECK SERVICING. Check oil for proper servicing and cap secure.

(5) Air intake and exhaust openings – CHECK. Check condition, security, and freedom from obstruction.

(6) Fuselage – CHECK CONDITION. Check for damage and popped rivets.

(7) Right oil drain valve – CHECK FOR WATER.

b. FRONT OF FUSELAGE.

(1) Windshield – CHECK PROTECTIVE COVERS REMOVED AND CONDITION.

(2) Engine compartment doors – OPEN AND LATCH. Check for damage and security.

(3) Fuel lines and fittings – CHECK FOR DAMAGE AND SECURITY.

(4) Electrical plugs and wiring – CHECK CONDITION AND PROPER ATTACHMENT.

(5) Spark plugs and high tension connections – CHECK FOR DAMAGE AND SECURITY.

(6) Cylinders – CHECK. Check cylinders for oil leaks and damage.

(7) Carburetor air duct – CHECK FOR CRACKS.

(8) Carburetor alternate air control linkage – CHECK FOR SECURITY.

(9) Throttle linkage – CHECK FOR SECURITY. Check throttle box for cracks and cables for fraying on the light weight throttle control system.

(10) Magneto and starter – CHECK FOR SECURITY AND LEAKAGE.

(11) Engine oil pump – CHECK FOR SECURITY AND LEAKAGE.

(12) Exhaust stacks and collector rings – CHECK FOR CRACKS AND SECURITY.

(13) Exhaust cowling and shroud – CHECK FOR CRACKS AND SECURITY.

(14) Exhaust opening – CHECK FOR OBSTRUCTIONS.

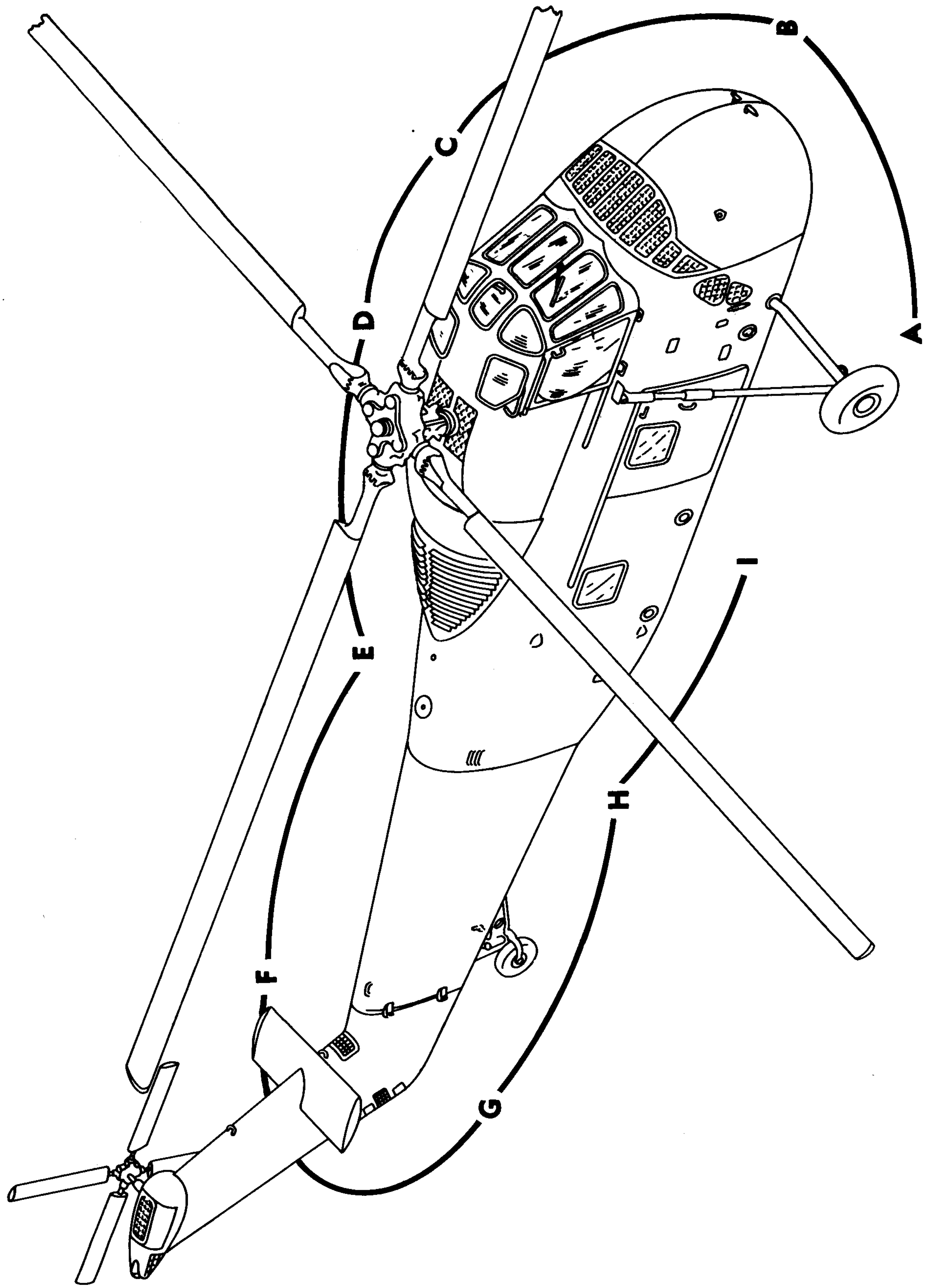


Figure 2–3. Exterior Check

(15) Forward bulkhead – CHECK CONDITION.

(16) Clutch diverter valve – CHECK IN RIGHT-HAND POSITION. (Model CH-34A serial No. 56-4313 and subsequent and Model CH-34C.)

(17) Landing light and fire detection system – CHECK. Check for security, damage, and cleanliness.

(18) Engine compartment doors – CLOSE AND LATCH.

(19) AN/ARA-31 antennas – CHECK FOR DAMAGE AND SECURITY.

c. LEFT FRONT OF FUSELAGE.

(1) Left oil drain valve – CHECK FOR WATER.

(2) Air intake and exhaust openings – CHECK. Check condition, security, and freedom from obstruction.

(3) Fuselage – CHECK CONDITION. Check for damage and popped rivets.

(4) Tire – CHECK. Check for slippage marks, proper inflation, and cracks.

(5) Static ground wire – CHECK. Check condition, ground contact, and security.

(6) Landing gear oleo strut – CHECK CONDITION. Check for damage, leaks, and proper extension.

d. LEFT SERVICE PLATFORM.

(1) Sliding windows and tracks – CHECK SECURE.

(2) Upper side of fuselage and gear box fairing – CHECK CONDITION.

(3) Static port – CHECK FOR OBSTRUCTIONS.

(4) Main gear box – CHECK FOR PROPER OIL LEVEL AND LEAKAGE.

(5) Primary servo hydraulic reservoir – CHECK FOR PROPER FLUID LEVEL AND LEAKAGE.

(6) Gear box support legs – CHECK FOR CRACKS.

(7) Oil system hoses – CHECK CONDITION AND FOR LEAKAGE.

(8) Hydraulic lines and fittings – CHECK CONDITION AND SECURITY.

(9) Electrical plugs and wiring – CHECK CONDITION AND PROPER ATTACHMENT.

(10) Flight control linkage – CHECK. Check for excessive play, binding, lubrication, and security.

(11) Servo units and lines – CHECK CONDITION AND FOR LEAKAGE. Check pilot valve BOOT FOR WATER OR ICE.

WARNING

Flights should not be made with damaged or deteriorated servo boots because of the danger of water being trapped around the servo pilot valves causing corrosion or freezing of the flight controls.

(12) Rotor brake – CHECK. Check for evidence of binding with brake off.

(13) Rotor brake support bracket – CHECK. Check for cracks around base.

(14) Rotor brake hydraulic lines – CHECK FOR DAMAGE AND LEAKAGE.

(15) Oil cooler – CHECK CONDITION. Check for leakage, security, and condition of fan belts.

(16) Transmission breather – CHECK FOR OBSTRUCTIONS.

(17) Star assembly and scissors – CHECK CONDITION. Check for security, lubrication, excessive play, or binding.

(18) Droop stop counterweights – CHECK RETRACTED.

(19) Blade damper – CHECK FOR LEAKAGE AND SECURITY. Check piston rods for security and condition.

(20) Damper reservoir – CHECK FOR PROPER FLUID LEVEL AND LEAKAGE.

(21) Blade horn, sleeve lock, and taper pins – CHECK SECURE.

(22) Rotor blades – CHECK CONDITION. Check for bonding separations, dents, or cracks.

(23) Service platform – CHECK FOR DAMAGE AND SECURITY.

e. LEFT REAR OF FUSELAGE.

(1) Fuselage – CHECK CONDITION. Check for damage and popped rivets.

(2) Cargo sling – CHECK SECURE.

(3) Emergency hatches – CHECK SECURE.

(4) Fuel vent lines – CHECK FOR OBSTRUCTIONS.

(5) Heater exhaust – CHECK FOR OBSTRUCTIONS.

(6) Radio antennas – CHECK CONDITION AND SECURITY.

(7) Heater vent line – CHECK FOR FUEL LEAKAGE.

(8) Bottom of fuselage – CHECK CONDITION. Check for damage, popped rivets, and fuel leakage.

f. LEFT SIDE OF PYLON.

(1) Tail cone – CHECK CONDITION. Check for damage and popped rivets.

(2) Pylon folded latch – CHECK FOR SECURITY.

(3) Tail wheel and casting – CHECK CONDITION. Check wheel for slippage marks and proper inflation, casting for cracks, and strut for leaks, damage, and proper extension.

(4) Pylon folding hinges – CHECK CONDITION.

(5) Left side of pylon – CHECK CONDITION.

(6) Tail rotor head components – CHECK CONDITION.

(7) Tail rotor blades – CHECK. Check for bonding separations, dents or cracks, and freedom to flap.

g. RIGHT SIDE OF PYLON.

(1) Tail rotor gear box – CHECK OIL FOR PROPER LEVEL AND LEAKAGE.

(2) Tail rotor gear box – CHECK INTAKE AND EXHAUST SCREENS FOR OBSTRUCTION.

(3) Right side of pylon – CHECK CONDITION AND STABILIZER FOR SECURITY.

(4) Intermediate gear box – CHECK OIL FOR PROPER LEVEL AND LEAKAGE.

(5) Intermediate gear box – CHECK INTAKE AND EXHAUST SCREENS FOR OBSTRUCTION.

(6) Pylon lockpin position indicator – CHECK RETRACTED.

(7) Pylon lockpin ratchet handle – CHECK SECURE.

(8) Tail cone – CHECK CONDITION. Check for damage and popped rivets.

h. RIGHT REAR OF FUSELAGE.

(1) Fuselage – CHECK CONDITION. Check for damage and popped rivets.

(2) Fuel vent lines – CHECK FOR OBSTRUCTIONS.

(3) Cabin windows – CHECK SECURE.

(4) Cargo door – CHECK SECURE.

(5) Center and aft fuel tank – CHECK. Check fuel for proper servicing and secure cap.

(6) Radio antennas – CHECK CONDITION AND SECURITY.

(7) Bottom of fuselage – CHECK. Check for damage, popped rivets, and fuel leakage.

(8) Cargo sling mounting brackets – CHECK SECURE.

(9) Fuel tank sump drains – CHECK FOR WATER.

i. RIGHT SERVICE PLATFORM.

(1) Sliding window emergency release mechanism – CHECK SECURE.

(2) Pitot tube – CHECK COVER REMOVED AND CONDITION.

(3) Deleted.

(4) Upper side of fuselage and gear box fairing – CHECK CONDITION.

(5) Servo units and lines – CHECK CONDITION AND FOR LEAKAGE. Check pilot valve boot for water or ice.

WARNING

Flights should not be made with damaged or deteriorated servo boots because of the danger of water being trapped around the servo pilot valves causing corrosion or freezing of the flight controls.

(6) Hydraulic lines and fittings – CHECK CONDITION AND SECURITY.

(7) Gear box support legs – CHECK FOR CRACKS.

(8) Flight control linkage – CHECK. Check for excessive play, binding, lubrication, and security.

(9) Rotor blades – CHECK CONDITION. Check for bonding separations, dents, or cracks.

(10) Auxiliary servo hydraulic reservoir – CHECK. Check for proper fluid level and leakage (Model CH-34A serial No. 56-4313 and subsequent and Model CH-34C).

(11) ASE control gyro, amplifier, and wiring – CHECK CONDITION AND SECURITY.

(12) Service platform – CHECK FOR DAMAGE AND SECURITY.

2–19. INTERIOR CHECK (ALL FLIGHTS).

a. Battery bus, ignition vibrator, and ground check circuit breakers – SET.

b. Generator switch – GEN.

c. Rotor brake lever – OFF (EXCEPT IN WINDS ABOVE 25 KNOTS).

d. Shoulder harness – CHECK CONDITION.

e. Flight controls – CHECK FOR FREE AND CORRECT MOVEMENT.

f. Electronics compartment personnel barrier switch – REL.

g. Auxiliary servo hydraulic fluid – CHECK. Check for proper fluid level and leakage (prior to Model CH-34A serial No. 56-4313).

h. Battery – CHECK CONNECTED, SUMP JAR FOR SECURITY. Check sump jar connections to the battery and vent line for security (Model CH-34A serial No. 56-4313 and subsequent and Model CH-34C).

i. Left static drain line – CHECK.

j. Cargo – CHECK.

k. Left side – CHECK SEATS OR LITTERS. Check for installation and condition.

l. Emergency hatches. – CHECK FOR SECURITY AND ACCESSIBILITY.

m. First aid kit – CHECK SEALED AND SECURE.

n. Electronics compartment – CHECK FOR SECURITY AND CONDITION. Check equipment, electrical plugs, and wiring for security and condition.

o. Static drain connection – DRAIN.

p. Heater and ignition unit – CHECK FOR SECURITY AND LEAKAGE.

q. Tail cone – CHECK.

r. Tail rotor cables – CHECK. Check for fraying or broken strands.

s. Electronics compartment dome light switch – OFF.

t. Battery – CHECK CONNECTED, SUMP JAR FOR SECURITY. Check sump jar connections to the battery and vent line for security (prior to Model CH-34A serial No. 56-4313).

u. Electronics compartment personnel barrier – CHECK UP AND LOCKED.

v. Right side – CHECK SEATS AND LITTERS. Check for installation and condition.

w. All cabin light switches – OFF.

x. Right static drain lines – CHECK.

y. Portable fire extinguisher – CHECK. Check sealed and for security.

z. Crew chief headset and radio control panel – CHECK.

aa. Clutch compartment – CHECK. Check compartment for foreign objects, leaks, and canted bulkhead for cracks.

2–20. INTERIOR CHECK (NIGHT FLIGHTS).

a. Flashlights – AVAILABLE.

b. All interior lights – CHECK.

c. All exterior lights – CHECK.

2–21. BEFORE STARTING ENGINE.

Note

If the helicopter is to be operated on an alternate grade fuel, refer to paragraph 2–6, Chapter 7.

a. Exterior and interior check – COMPLETED.

b. Shoulder harness and safety belt – FASTENED.

c. Shoulder harness inertia reel lock lever – CHECK. Check operation of the inertia reel in both the LOCKED (forward) and UNLOCKED (aft) positions.

d. Seat height adjustment lever – ADJUST FOR HEIGHT.

e. Tail rotor pedal adjustment knobs – ADJUST.

f. Alarm bell – CHECK.

Note

Alarm bell should be checked prior to battery switch being placed on and external power being plugged in.

g. Radio circuit breakers – SET.

h. Tail wheel lock handle – LOCKED.

i. Parking brake handle – LOCKED.

j. Collective pitch lever – DOWN, FRICTION OFF.

k. Throttle – CLOSE, FRICTION OFF.

l. Cyclic stick, collective pitch lever, and tail rotor pedals – ACTUATE THROUGH FULL TRAVEL.

m. Standby compass and free air temperature gage – CHECK.

n. Rotor brake lever – OFF (EXCEPT IN WINDS ABOVE 25 KNOTS).

o. All overhead switches – OFF (EXCEPT STICK TRIM SWITCH AND RADIO MASTER SWITCH).

p. Circuit breakers (overhead circuit breaker panel) – SET.

q. Pilots' compartment dome light switch – AS REQUIRED.

r. First aid kit – CHECK SEALED AND SECURE.

s. Fuel flow selector valve handle – ON.

t. Mixture lever – IDLE CUT-OFF.

u. Carburetor air lever – DIRECT.

v. Clutch pump switch – OFF.

w. Collective pitch lever switches – SERVO ON, ALL OTHERS OFF.

x. Fuel transfer pump switches – OFF.

y. Radios – OFF.

z. External power – CONNECTED.

Note

External power should be provided for starting and ground operation to prevent excessive draining of battery. Battery should only be used for starting when an external power source is not available. When external power is not available, follow normal starting procedure, but place battery switch in BATT position. Battery does not energize secondary bus.

aa. Automatic stabilization equipment – OFF.

(1) Channel selector switch – LOCKED IN PITCH POSITION.

(2) Channel disengage switches – OFF.

(3) Override check switch – CENTER POSITION.

(4) Yaw trim knob – CENTERED.

(5) CG trim knob – CENTERED.

2–22. STARTING ENGINE.

Note

For procedure to be followed in event of fire, refer to paragraph 3–1, Chapter 4.

a. Fire guard – POSTED.

b. Collective pitch lever – MINIMUM AND LOCKED.

c. Throttle – CLOSED.

Note

Friction should be applied before starting engines. With no friction applied throttle will tend to spring toward open due to action of carburetor balance spring.

CAUTION

Caution should be taken to prevent engine overspeed on helicopters not equipped with a throttle limit switch, because engine can be started with throttle in any position.

Note

A sloppy link override with a light spring force is provided at both open and closed throttle positions, with a detent at beginning of override, which is felt in throttle twist-grip.

The throttle must be out of override position and just over the detent at closed throttle position in order to close throttle limit switch.

d. Ignition switch – OFF.

e. Flight instrument inverter switch – MAIN.

f. Fuel booster pump switch – FUEL BSTR PUMP.

g. Engine instruments – CHECK STATIC POSITION.

h. Starter button – DEPRESS.

CAUTION

Crank engine for 3 to 5 seconds by energizing starter to check for hydraulic lock. If there is unusually high compression, have spark plugs removed from lower cylinders and all liquid drained from cylinders. Presence of any quantity of liquid in combustion chamber is likely to cause serious damage to engine.

i. Ignition switch – BOTH. Turn ignition switch to BOTH after checking for hydraulic lock.

j. Engine primer button – CLIMATIC.

(1) Cold engine – CONTINUOUS.

(2) Warm or hot engine – INTERMITTENT.

Note

If engine fails to start in 30 seconds, allow starter to cool for 1 minute and then repeat starting procedure. After three attempts, allow starter to cool for 30 minutes.

k. Mixture lever – RICH. Place mixture lever in the RICH position when engine is firing smoothly on prime. Continue priming until engine rpm starts to drop, then release primer switch.

Note

Engine may flood if not firing when mixture lever is out of IDLE CUT-OFF position.

l. Engine oil pressure gage – CHECK.

CAUTION

If oil pressure does not register within 10 seconds or reach 40 psi within 20 seconds, stop engine and investigate.

m. Throttle – 1000 ENGINE RPM. Maintain 1000 engine rpm (± 100 rpm) until oil pressure has stabilized.

CAUTION

Do not pump the throttle after starting while the engine is still cold as it frequently causes backfiring. Backfiring may cause damage to the induction system and it also presents a fire hazard.

Note

Do not allow engine to exceed 1400 rpm on start. Engine may have a tendency to overspeed due to no-load condition when rotor is disengaged.

n. Flight control servo switch – AUX. OFF. Check auxiliary servo hydraulic pressure gage. Pressure should remain constant. Check main rotor controls for free and easy movements.

Note

Auxiliary servo hydraulic system should not shut off when switch is placed in AUX. OFF position, as there is no pressure in primary servo hydraulic system until after clutch engagement.

o. Flight control servo switch – ON.

p. Ignition switch – CHECK. Idle engine at 1000 ± 100 rpm. Turn switch OFF momentarily to see if engine stops firing. Turn ignition switch to L (left) and R (right) magneto positions momentarily to insure that both magnetos are firing.

CAUTION

Perform check as rapidly as possible to prevent backfire and possible damage to induction system.

q. Ignition switch – BOTH.

r. Fuel flow selector valve handle – EMER ON.

2–23. ENGINE GROUND OPERATION.

CAUTION

If it becomes necessary to run the engine on the ground for an extended period without engaging main rotor, engine speed should be limited to a maximum of 1400 rpm to prevent overheating clutch. External power should be connected to provide electrical power for helicopter.

a. Throttle – 1400 ENGINE RPM. Thoroughly warm up engine before engaging rotor.

Note

Prior to rotor engagement, warm engine until oil temperature reaches 40°C or 6°C above prestart and oil pressure stabilizes, whichever occurs first.

b. Cyclic stick trim system – CHECK.

(1) Cyclic stick trim master switch – ON.

(2) Cyclic stick – MOVE IN ALL DIRECTIONS FROM NEUTRAL POSITION. Check that resistance increases as displacement of cyclic stick is increased.

(3) Cyclic stick trim release switch – DEPRESS. Resistance to movement of cyclic stick should stop immediately.

(4) Cyclic stick – MOVE TO EXTREME LEFT POSITION WITH CYCLIC STICK TRIM RELEASE SWITCH DEPRESSED AND THEN RELEASE SWITCH. Cyclic stick should remain in position.

(5) Cyclic stick – MOVE TO EXTREME RIGHT POSITION. Check that resistance increases as displacement of cyclic stick is increased.

CAUTION

Do not depress cyclic stick trim release switch after moving cyclic stick from one extreme position to other. Trimming cyclic stick in one extreme position and then moving cyclic stick to opposite extreme position causes maximum extension of force gradient spring. When cyclic stick trim release switch is depressed, spring tension is released. Force created by releasing spring at maximum extension may cause damage to flight control system.

(6) Cyclic stick – RETURN TO NEUTRAL POSITION AND TRIM.

(7) Cyclic stick – PERFORM CHECKS OUTLINED IN STEPS (4) AND (5), TRIMMING CYCLIC STICK IN EXTREME RIGHT, FORWARD, AND AFT POSITIONS. Trim cyclic stick in neutral position after performing each check.

(8) Cyclic stick trim master switch – OFF. Actuate cyclic stick in all directions and ascertain that there is no resistance.

(9) Cyclic stick trim master switch – ON. Check for resistance as cyclic stick is displaced and returned to neutral.

c. Automatic stabilization equipment – CHECK.

(1) Throttle – 1600 ENGINE RPM.

(2) Cyclic stick – CENTERED.

(3) Tail rotor pedals – CENTERED, FEET ON PEDALS.

(4) Collective pitch lever – MINIMUM.

(5) Altitude channel disengage switch – OFF.

(6) ASE engage button – DEPRESS. The engage button should not be depressed sooner than 2-1/2 minutes after generator power has cut in or external power is plugged in; the green light in the button should come on. If this light does not come on, wait an additional 1/2 minute and depress the engage button again.

(7) ASE standby button – DEPRESS. Green light will go out.

NOTE

It is necessary to first engage the equipment and then place it in standby to connect AC operating power to the equipment.

2-24. ROTOR ENGAGEMENT.

CAUTION

Rotor should not be engaged in winds above 45 knots or when wind gusts cause excessive blade flapping. When conditions necessitate engaging or disengaging of rotor in high or gusty winds, a sheltered area should be utilized and engagement and disengagement should be accomplished as rapidly as possible.

External power, when available, should be connected throughout rotor engagement procedure to prevent excessive loads on battery, since generator is inoperative until main rotor accelerates to approximately 124 rotor rpm (equivalent to 1400 engine rpm). "Missed engagements" and damage to fuel pumps in use may result, due to low voltage, if battery is weak and external power is not used.

a. Area – CLEAR.

b. Rotor brake lever – OFF.

c. Rotor brake warning light – OFF.

CAUTION

When releasing rotor brake, be sure that lever snaps into detent for unlocked position to prevent partial application of rotor brake due to weight of rotor brake lever.

d. Mixture lever – RICH.

e. Throttle – 1600 TO 1700 ENGINE RPM.

Note

After engine is started, auxiliary servo hydraulic pressure will be available and may cause tail rotor pedals to creep. This will happen only if, at shutdown after previous flight, rotor clutch is disengaged before automatic stabilization equipment has been placed in standby. Pedal creeping can be overcome with moderate pressure on pedals and will disappear as soon as full automatic stabilization power is available after rotor engagement.

f. Clutch switch – CLUTCH.

g. Rotor – ENGAGE. During clutch engagement, as rotor speed accelerates to approximately 50 rotor rpm (equivalent to 565 engine rpm), move cyclic stick a slight amount in all directions and observe tip-path plane of main rotor blades for proper response of flight controls.

WARNING

If flight controls do not respond correctly, do not complete rotor engagement. Shut down by placing clutch switch in the OFF position. This condition may be due to ice formation within flight control servo unit boot, if boot is deteriorated and allows water to enter, rendering primary servo pilot valves inoperative.

CAUTION

If, on helicopters prior to serial No. 56-4313, engine oil tanks are serviced when left side of the helicopter is higher than right side, a low oil level in left engine oil tank will occur. This would result in difficulty in clutch engagement or improper operation of clutch. (Refer to paragraph 2–19, Chapter 9.)

h. Clutch switch – OFF.

i. Clutch circuit breaker – SET.

j. Transmission oil pressure gage – CHECK.

k. Throttle – 1700 ENGINE RPM FOR 1 TO 2 MINUTES TO DRAIN CLUTCH.

l. Droop stops – CHECK RELEASED.

2-25. GROUND TESTS.

Note

Even if taxiing is not to be performed, accomplish necessary steps in this paragraph and paragraph 2–28 before accomplishing steps in paragraph 2–31.

a. External power – DISCONNECTED.

b. Battery switch – BATT.

c. Throttle – 1800 ENGINE RPM.

d. Servo hydraulic pressure gages – CHECK.

e. Servo switch – AUX. OFF. Check all flight controls for proper operation on primary servo hydraulic system. Check auxiliary servo pressure gage for decrease in pressure. Pressure drop will indicate proper operation of pressure switch.

CAUTION

Check that automatic stabilization equipment is disengaged before shutting off auxiliary servo.

f. Servo switch – ON. Check auxiliary servo hydraulic pressure gage for increase in pressure to normal operating range.

g. Servo switch – PRI. OFF. Check all flight controls for proper operation on auxiliary servo system. Check primary servo hydraulic pressure gage for decrease in pressure. Pressure drop will indicate proper operation of pressure switch.

h. Servo switch – ON. Check primary servo pressure gage for increase to normal operating range.

CAUTION

When performing servo system checks, keep finger on servo switch and be prepared to return switch to the ON position in event of any erratic behavior or malfunction of flight control system when switch is placed in PRI. OFF or AUX. OFF position.

i. Ammeter – CHECK. Check reading before turning on radio equipment. Note increase in reading after turning on radio equipment.

j. Radio switches – ON AS REQUIRED.

k. Fire detector warning light and test switch – CHECK.

l. Flight instrument inverter switch – CHECK. Check for operation of spare inverter by placing switch in the SPARE position and noting that instrument power failure warning light does not light. Return switch to MAIN.

m. Fuel booster pump switch – OFF.

Note

Prior to first flight of each day and after each refueling, place fuel flow selector valve handle in the EMER ON position, fuel booster pump switch OFF, fuel transfer pump switches OFF, and operate engine for 5 minutes on emergency fuel system to eliminate any water that may have collected in fuel line.

n. Fuel gage test switch – CHECK.

o. All engine and transmission temperature and pressure gages – CHECK FOR READINGS WITHIN THE OPERATING RANGE AT 1800 ENGINE RPM.

p. ASE engage button – DEPRESS. Automatic stabilization equipment possesses ample authority to compensate main rotor torque during takeoffs and landings.

Note

Any tendency for tail rotor pedals to creep should have corrected itself by this time, whether automatic stabilization equipment is engaged or not.

CAUTION

If any erratic behavior in control system is encountered when automatic stabilization equipment is engaged, press AUTO STAB RELEASE button on cyclic stick grip.

q. CG trim knob – ADJUST. Adjust to approximate cg location. If cg location is not known, center null indicator needle.

2–26. TAXIING INSTRUCTIONS.

2–27. Taxiing in congested parking areas should be held to a minimum. For ground clearances and for clearances required to execute 180-degree taxiing turns, see figure 2–4.

CAUTION

Avoid taxiing behind heavy aircraft during engine runup as their prop wash will cause excessive blade flapping and may upset helicopter.

When light planes are parked in immediate area, pilot must take extreme caution during ground operations and takeoffs as rotor wash may upset light aircraft.

Maintain a minimum of 2400 engine rpm while taxiing, so an immediate takeoff can be accomplished by increasing collective pitch if wind should tilt helicopter or in event of other emergencies.

2–28. TAXIING PROCEDURE.

CAUTION

Tail of helicopter has a tendency to swerve during taxiing due to location of tail rotor which is above full-swiveling tail wheel. Care should be taken in application of tail rotor control to prevent this swerving.

Do not taxi rearward as visibility is limited and damage to tail rotor may result.

NOTE

MINIMUM GROUND CLEARANCES

MAIN ROTOR BLADES STATIONARY	9 FEET 7 INCHES
MAIN ROTOR BLADES CLUTCH – ENGAGED COLLECTIVE PITCH LEVER – MINIMUM CYCLIC STICK – NEUTRAL	11 FEET 10 INCHES
TAIL ROTOR BLADES STATIONARY OR ENGAGED	6 FEET 5 INCHES
BOTTOM OF FUSELAGE *CHECK ANTENNAS THAT MAY PROTRUDE LOWER	*1 FOOT 6 INCHES

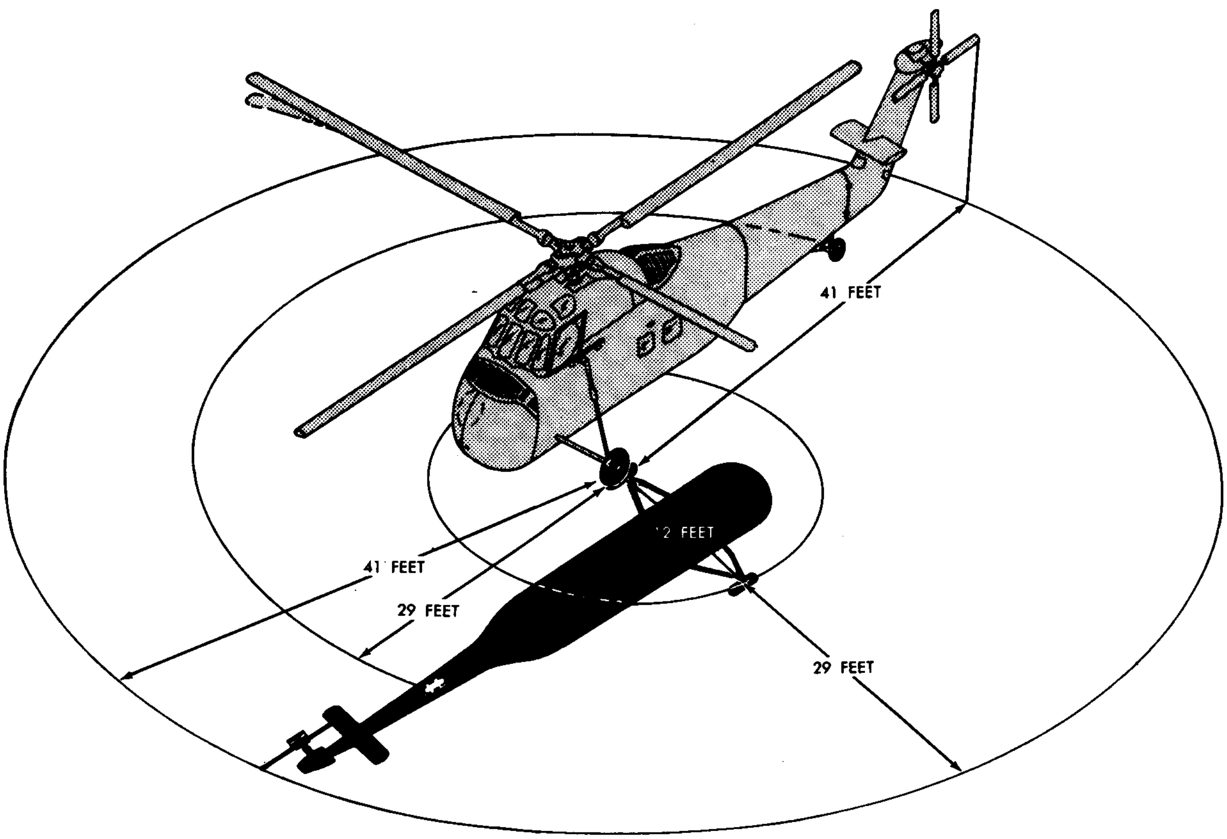


Figure 2–4. Minimum Turning Radius and Ground Clearances

a. Crew and passenger safety belts – FASTENED.

b. All tiedowns – REMOVED.

c. Wheel chocks – REMOVED.

d. Parking brake handle – OFF.

e. Tail wheel lock handle – UNLOCKED.

f. Collective pitch lever – MINIMUM.

g. Throttle – 2400 TO 2500 ENGINE RPM.

h. Cyclic stick – FORWARD.

i. Collective pitch lever – INCREASE. Increase collective pitch slightly until forward motion is obtained (15 knots maximum).

CAUTION

Use minimum collective pitch required for forward motion to prevent main rotor from developing sufficient lift to cause extension of landing gear oleo struts.

If main rotor blades hit droop stops while taxiing with cyclic stick forward, increase collective pitch slightly to lift blades from droop stops.

j. Tail rotor pedals – MAINTAIN HEADING. Maintain heading by use of tail rotor pedals and, if necessary, wheel brakes.

Note

Automatic stabilization equipment will hold a steady heading while taxiing if feet are removed from tail rotor pedals; however, ability of automatic stabilization equipment to hold a heading will depend on rotor rpm, wind velocity, and runway conditions. A tendency to overshoot while taxiing does not indicate malfunctioning and can be easily suppressed by foot pressure on tail rotor pedals.

k. Turn-and-bank indicator – CHECK NEEDLE FOR PROPER MOVEMENT AND BALL FREE IN THE RACE.

l. Cyclic stick – AS DESIRED. Regulate taxi speed with fore and aft movements of cyclic stick.

m. Trim release button – DEPRESS. Adjust cyclic stick trim as desired.

Note

Landing light may be extended to desired position for use while taxiing at night.

Helicopter should be stopped by turning into wind and applying wheel brakes.

2–29. CROSSWIND EFFECTS.

2–30. When taxiing crosswind, the helicopter will have a tendency to weathercock into the wind. This condition is the result of the wind striking the tail cone and pylon, and can be corrected by proper application of the tail rotor pedals and wheel brake. Particular attention should be given to the position of the cyclic stick to the relative wind. The cyclic stick should be held into the wind to prevent high coning of the main rotor blades which would create a tendency for the helicopter to tip over in strong winds.

2–31. BEFORE TAKEOFF.

2–32. PREFLIGHT ENGINE CHECK.

a. Fuel flow selector valve handle – ON.

b. Fuel booster pump switch – FUEL BSTR PUMP.

c. Aft fuel transfer pump switch – AFT.

d. Carburetor air lever – DIRECT.

e. Mixture lever – NORMAL. Check proper operation by moving the mixture lever to the NORMAL position. Engine should continue to operate normally.

f. Mixture lever – RICH.

g. Freewheeling unit – CHECK. Check freewheeling unit by advancing throttle to 2200 engine rpm. Decrease throttle rapidly enough to split rotor and engine tachometer needles momentarily. Increase throttle to 2200 engine rpm.

WARNING

If tachometer needles do not split or if rotor rpm decreases as rapidly as engine rpm, freewheeling unit is malfunctioning. Do not take off, as autorotation would be impossible.

h. Ignition system check – ACCOMPLISH AT 2200 ENGINE RPM AND 25 INCHES HG MANIFOLD PRESSURE. Maximum allowable drop on either L (left) or R (right) magneto position is 75 engine rpm.

CAUTION

Engine roughness, such as that caused by ignition malfunction, is transmitted directly to helicopter rotor and causes abnormal vibration in the form of twitching or lashing of helicopter structure. These vibrations overstress the transmission and rotor and may cause damage or lead to failure of these components.

Note

If an unacceptable ignition system check occurs, refer to paragraph 2–8, Chapter 9.

i. ASE engage button – DEPRESS.

j. All engine and transmission instruments – CHECK.

2–33. PREFLIGHT AIRCRAFT CHECK.

a. Navigation radio – CHECK OPERATION.

b. Flight instruments – CHECK.

(1) Directional indicator – CHECK FOR PROPER HEADING AGAINST STANDBY COMPASS, SET AS DESIRED.

(2) Compass slaving switch – IN.

(3) Vertical velocity indicator – ZERO INDICATIONS.

(4) Altimeter – SET.

(5) Attitude indicator – CHECK ERECTED AND FOR PROPER INDICATION.

c. Parking brake handle – OFF.

d. Tail wheel lock handle – AS DESIRED.

Note

Place tail wheel lock handle in LOCKED position for rolling takeoff.

e. Pitot heater switch – CLIMATIC.

(1) Visible moisture – ON.

(2) Normal – PITOT HEAT.

f. Flight controls – CHECK. Check all controls for smoothness of operation.

CAUTION

Restrict control movements to a small range to prevent lifting or tilting helicopter.

g. Crew and passengers – ALERTED FOR TAKEOFF.

h. Rotating anti-collision light switch – ON.

2–34. TAKEOFF.

WARNING

Takeoff is prohibited with snow or ice on helicopter. Failure to remove snow and ice accumulated on helicopter while on ground can result in serious aerodynamic and structural effects when flight is attempted. Depending on weight and distribution of snow and ice, takeoff, hovering, and climb-out performance can be adversely affected. Roughness, pattern, and location of snow and ice can affect blade stall speeds and handling characteristic to a dangerous degree. Inflight structural damage can also result from vibrations in flight induced by unbalanced loads of unremoved accumulations. These hazards will be eliminated by removing all snow and ice accumulations prior to flight.

CAUTION

Due to full-swiveling tail wheel and high power developed by tail rotor, helicopter has a tendency to swerve during ground operation. Use tail rotor pedals cautiously to prevent swerving while compensating for increased main rotor torque during takeoff.

Note

For procedures to be followed in event of engine failure on takeoff, refer to paragraph 2–3, Chapter 4.

2–35. TYPES OF TAKEOFF.

2–36. Because of the versatility of helicopters and their ability to take off from small areas, conditions at the time of takeoff will be the governing factors in the type of takeoff to be accomplished. The factors governing the type of takeoff to be accomplished are wind velocity, gross weight of the helicopter, density altitude at which takeoff is to be accomplished, and the size and condition of the takeoff area. The following paragraphs describe the types of takeoff to be accomplished under various conditions.

2–37. NORMAL TAKEOFF TO A HOVER. (See figure 2–5.) The normal takeoff to a hover is the most common type of takeoff and should be used when possible. Normal takeoffs to a hover can be accomplished at moderate altitudes and with normal gross weights. In this type of takeoff, the safety factor is high as the helicopter is lifted from the ground vertically to a height of 5 to 10 feet where the flight controls and power plant may be checked for normal operation before continuing to climb.

Note

For normal takeoffs to a hover, engine rpm required will vary with gross weight and atmospheric condition. Normally, 2500 rpm is sufficient, but at high gross weights or at high altitude it may be necessary to increase engine rpm to 2800, which is maximum rpm.

a. Parking brake handle – OFF.

b. Tail wheel lock handle – AS DESIRED.

c. Collective pitch lever – MINIMUM.

d. Throttle – MAXIMUM RPM.

e. Collective pitch lever – INCREASE. Increase pitch steadily as the helicopter leaves ground, maintaining maximum engine rpm with throttle.

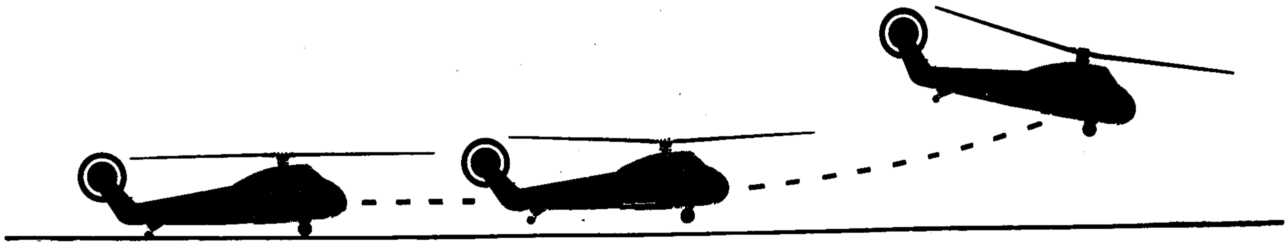
Note

ASE will maintain a constant heading within 5 degrees in either direction throughout a power increase or decrease of 7 inches Hg manifold pressure.

Prevent helicopter from swerving by use of tail rotor pedals if automatic stabilization is not used. As collective pitch is increased, helicopter will have a tendency to swing to right which should be counteracted by additional pressure on left tail rotor pedal.

f. Altitude – 5 TO 10 FEET.

g. Flight controls – CHECK. Check all controls for proper operation.



TAIL WHEEL LOCK HANDLE – LOCKED. PARKING BRAKE HANDLE – UNLOCKED. THROTTLE – ADVANCE TO MAXIMUM RPM. GENTLY EASE CYCLIC STICK FORWARD AND INCREASE COLLECTIVE PITCH AS IN TAXIING.

CONTINUE TO INCREASE COLLECTIVE PITCH, MAINTAINING MAXIMUM RPM, AND ACCELERATE THE HELICOPTER AS RAPIDLY AS POSSIBLE ON THE GROUND.

AS GROUND SPEED INCREASES, SUFFICIENT LIFT WILL BE DEVELOPED TO ACCOMPLISH TAKEOFF.

MOVE CYCLIC STICK TO MAINTAIN SHALLOW CLIMB AS COLLECTIVE PITCH AND THROTTLE ARE INCREASED TO BECOME AIRBORNE.

CAUTION

WHEN TAKING OFF CROSSWIND, HOLD THE CYCLIC STICK SLIGHTLY INTO THE WIND TO CORRECT FOR DRIFT AS THE HELICOPTER BECOMES LIGHT ON THE GEAR PRIOR TO BECOMING AIRBORNE.
THE HELICOPTER WILL HAVE A TENDENCY TO LEAVE THE GROUND IN A SLIGHTLY NOSE DOWN ATTITUDE. CARE SHOULD BE EXERCISED TO AVOID STRIKING THE MAIN WHEELS ON THE GROUND AFTER BECOMING AIRBORNE.

AS THE HELICOPTER BECOMES AIRBORNE, MAINTAIN MAXIMUM POWER UNTIL THE DESIRED CLIMBING AIRSPEED IS OBTAINED.

MAINTAIN DIRECTIONAL CONTROL BY MEANS OF THE TAIL ROTOR PEDALS.

NOTE

THIS TECHNIQUE WILL PRODUCE THE RESULTS STATED IN CHAPTER 14.

Figure 2–8. Rolling Takeoff (Typical)

e. Cyclic stick – TRIM AS DESIRED.

2–43. CLIMB.

Note

The following technique will produce the results stated in Chapter 14.

2–44. For proper power setting, refer to table 2–V, Chapter 14. As the helicopter accelerates from hovering flight to flight in any direction, it passes through a transitional period. If engine power, rpm, and collective pitch are held constant in calm air, a momentary settling will be noted when the cyclic stick is moved forward to obtain forward speed. This momentary settling condition is a result of the helicopter moving from the ground cushion and the tilting of the tip-path plane of rotation of the main rotor blades to obtain forward airspeed. Wind velocity at the time of takeoff will partially eliminate this settling due to the increased airflow over the main rotor blades. As wind velocity increases, this settling will be less pronounced. After the helicopter accelerates forward to between 10 to 15 knots airspeed, less power is required to sustain flight due to increase in aerodynamic efficiency as airspeed is increased to best climbing speed. Takeoff power should be maintained until a safe autorotative airspeed of 60 knots is attained; then power may be adjusted to establish the desired rate of climb.

CAUTION

During climbs at low altitude, a safe autorotative speed should be maintained, so that in event of engine failure, sufficient but not excessive speed is available to accomplish a safe autorotative landing. Airspeeds to avoid at low altitude are shown in chart 2–I, Chapter 7.

If necessary to clear ground obstructions after takeoff, vertical climbs can be accomplished; however, operation within shaded area of chart 2–I, Chapter 7, should be held to a minimum. Accelerating helicopter to optimum climbing airspeed in a shallow climb eliminates critical settling and the possibility of helicopter striking ground on takeoff.

2–45. ASE OPERATION.

2–46. BAROMETRIC ALTITUDE CONTROL.

a. Cyclic stick – ADJUST. Reposition the cyclic stick for cruise.

b. Altitude – STABILIZE.

c. Airspeed – STABILIZE.

d. Throttle – STABILIZE.

e. ASE barometric altitude button – DEPRESS.

f. Collective pitch lever lock nut – APPLY FRICTION.

2–47. ALTITUDE CHANGES.

a. ASE barometric altitude (off button) – DEPRESS.

b. Altitude – CLIMB OR DESCEND (AS DESIRED).

c. Altitude – STABILIZE.

d. Airspeed – STABILIZE.

e. Throttle – STABILIZE.

f. ASE barometric altitude button – DEPRESS.

g. Collective pitch lever lock nut – APPLY FRICTION.

2–48. TURNS.

2–49. Turns, using the automatic stabilization equipment, may be affected in one of two ways:

a. By actuating the tail rotor pedals; after the turn is completed and the helicopter is on the desired course, the feet should be removed from the pedals and the helicopter will maintain the new heading. A slow or fast turn may be made by depressing the tail rotor pedals accordingly.

b. By using the yaw trim knob; for turns while hovering, rotate the knob left or right slowly and smoothly to produce the turn desired. With forward speed, this control will be very convenient for small turns of 1 to 10 degrees. Large turns can be made, but will cause the helicopter to skid unless they are made very slowly or the pilot banks the helicopter while the knob is being rotated to prevent skidding.

2–50. FLIGHT CHARACTERISTICS.

2–51. Information regarding flight characteristics of the helicopter will be found in Chapter 8.

2–52. SYSTEMS OPERATION.

2–53. Information pertaining to the operation of various systems is covered in Chapter 9.

2–54. DESCENT.

a. Carburetor air lever – DIRECT.

b. Mixture lever – RICH.

c. Fuel booster pump switch – FUEL BSTR PUMP.

Note

Prior to leaving altitude in preparation for landing, depress the ASE barometric altitude OFF button. (This will disengage altitude mode of operation.)

2–55. PRETRAFFIC PATTERN CHECKLIST.

a. Crew and passengers – ALERTED AND SAFETY BELTS FASTENED.

b. Altimeter – SET.

c. Fuel flow selector valve handle – ON.

d. Aft and center fuel transfer pump switch – AS REQUIRED.

2–56. TRAFFIC PATTERN CHECKS.

a. Parking brake handle – AS DESIRED.

b. Tail wheel lock handle – AS DESIRED (LOCKED FOR ROLLING OR AUTOROTATIVE LANDINGS).

c. Cabin heater switch – OFF (ON FINAL LANDING). Allow heater fan to continue to operate and lower duct air temperature before shutdown.

2–57. LANDING.

Note

For landing emergencies refer to paragraph 5–1, Chapter 4.

2–58. LANDING SITE EVALUATION.

2–59. The versatility of the helicopter permits safe operation from unfamiliar and unprepared operating sites such as open fields, mountain knolls and ridges, heavily wooded areas, beaches, and snow and ice areas. Any of the aforementioned areas must be properly evaluated and the pilot must use the proper techniques to effect landings and takeoffs from these sites. Although the helicopter is designed for, and capable of operation from, very restricted areas, the final analysis of the situation and the decision to land must be determined by the best professional judgment of the pilot. Prior to attempting operation of the helicopter from unprepared areas, the pilot must consider certain basic factors and evaluate one against the other to determine what undesirable factors will be present in the contemplated operation. These factors are as follows:

2–60. APPROACH AND TAKEOFF OBSTACLES. Obstacles such as trees, hills, buildings, wires, etc, must be considered prior to attempting operation from any unprepared area. In many instances, a

crosswind or downwind approach may be advisable to avoid such obstructions on the approach to an area. In order to allow for gustiness, sudden reversal or direction of light winds, below normal performance of power plant, cg at aft limits, and variations in pilot technique, the obstacle height on takeoff or landing must be carefully evaluated.

2-61. SIZE OF USABLE AREA. The size of the usable area can be determined by a low speed pass into the wind over the intended landing site. Generally, the landing area should be a level and cleared area approximately twice the diameter of the main rotor disc area. The pilot must consider density altitude, gross weight, personal skill, and wind and obstacles when evaluating the suitability of the landing area.

2-62. WIND DIRECTION, VELOCITY, AND CONSISTENCY. The effects of wind on takeoffs and landings are very important factors in the operation of the helicopter; however, in planning critical helicopter operation, the wind should not be relied on to accomplish a landing and takeoff from an obstructed area. If the helicopter were riding a gust on the final approach and the gust should decrease as the helicopter was approaching a hover, the helicopter would probably "fall through" if the wind factor was planned on to execute the landing. This condition would also hold true during the initial phase of takeoff. If an operation is dependent upon wind conditions, all other conditions being marginal, the helicopter should be lightened. When a landing area is determined to be marginal, the pilot should select another area. Another effect of wind that must be considered is the "lee-effect" of the wind over hills, ridges, and obstacles. The downdrafts, resulting from these conditions, particularly effect the initial phase of takeoff or the final phase of landing.

2-63. GROSS WEIGHT. The gross weight of the helicopter is an important factor to be considered in determining the feasibility of any contemplated helicopter operation. The pilot must know the actual gross weight of the helicopter to adequately evaluate the situation. In all instances, the fuel load, equipment, and personnel should be kept to the minimum required to accomplish the mission.

2-64. OPERATING SURFACE (TERRAIN EVALUATION). After the preceding factors have been considered and a landing considered practicable, the surface condition must be evaluated. In helicopter operation, the presence of shrubs, brush, stumps, rocks, holes, soft surfaces, etc, are a definite hazard to landing. The selected landing spot must be free of any obstacles that will result in damage to the helicopter. Prior to attempting a landing, the pilot should "drag" the area several times and select that spot at which the helicopter can be landed with adequate fuselage, tail rotor, and main blade clearances, and determine the most desirable approach to accomplish an into-the-wind landing and subsequent takeoff.

2-65. EXPECTED HELICOPTER PERFORMANCE. The final step in the evaluation of a landing site is the expected helicopter performance during landing and subsequent takeoff. After the size of the area and the effect of the obstacles, gross weight, and density altitude have been determined, the performance charts contained in Chapter 14 should be referred to, and the practicability of the contemplated operation determined.

2-66. ROUGH TERRAIN. The helicopter is capable of operating safely from most rough surfaces, provided the pilot uses the proper techniques. In selecting the direction of landing into rough terrain, the pilot must consider wind and condition of the surface. When the wind velocity is less than 10 knots, it may be considered secondary in importance. This is not intended to imply that a crosswind landing should be made, and certainly not a downwind approach and landing, but is intended to stress the advisability of considering terrain over wind in rough terrain operation. When landing on a plowed or furrowed surface, the helicopter should be landed either parallel to, or directly across, the furrows. When landing parallel, either the right or left main gear should be placed in the low trough. When landing across the furrows, the main gear should be placed in the trough to prevent sliding or skidding. Accomplish the landing by maintaining takeoff rpm and slowly reducing pitch until it is determined that the helicopter is properly positioned in the furrows. All landings in rough or furrowed terrain should be made with the parking brakes and tail wheel locked to prevent the helicopter from turning or rolling after the landing is completed.

2-67. ROCKY TERRAIN. Landings on rocky terrain are the most difficult to accomplish in a helicopter, due to the extreme variation in the size and position of the rocks. When a landing is required on an extremely irregular surface, it may be advisable to lower personnel from a minimum altitude hover position to improve the landing site or to aid in directing the touchdown prior to attempting a landing. The parking brakes and tail wheel should be locked to prevent the helicopter from turning or moving once the landing has been completed. Prior to shutting down the engine, the wheels should be chocked to prevent any inadvertent movement of the helicopter when starting. As in other rough terrain, pitch should be slowly decreased while maintaining 2500 engine rpm until the landing is safely accomplished.

Note

Pilot should always maintain 2500 engine rpm on an unprepared surface until it has been determined that surface will support helicopter. This will permit immediate takeoff if helicopter should start to tip over or sink into surface.

Prior to any landings, other than emergency landings, pilot should thoroughly inspect the area for all hazards that may be present. Existing factors (including skill) affecting approach, touchdown, and takeoff should be carefully evaluated by pilot. Approach to landing, point of touchdown, and takeoff should be completely planned by pilot before first landing attempt. If any factor raises slightest question in pilot's mind as to safe accomplishment of landing and takeoff, a new landing area should be selected or mission aborted.

2–68. APPROACH PROCEDURES.

2–69. NORMAL APPROACH. The objective of a normal approach and landing is to bring the helicopter to a hover over the spot of intended landing by gradually decreasing airspeed to 60 knots and by establishing a constant approach angle of approximately 30 degrees. During the approach, engine speed should be maintained at 2500 rpm and corrections for overshooting or undershooting the intended landing spot should be made by increasing or decreasing power and collective pitch. This will vary the approach angle. As the landing spot is approached, decrease airspeed and rate of descent to attain a hovering attitude below 10 feet. Sufficient altitude should be maintained while maneuvering the helicopter in preparation for landing in order to avoid scuffing the wheels on the ground. (Refer to paragraph 2–75 and figure 2–9.)

2–70. STEEP APPROACH. The steep approach procedure is a precision power controlled approach (over 30 degrees) used to clear obstructions and to accomplish a landing in confined areas. The rate of descent in a steep approach should not exceed 400.fpm and some forward movement should be maintained at all times. Since a reasonable amount of power will be required to control the rate of descent (power required is governed by the gross weight), a minimum amount of additional power will remain to accomplish a hover. If too great a rate of descent is reached at slow speeds, extreme roughness and a loss of control due to power settling may occur. The approach should be made by holding a minimum of 2500 engine rpm and by depressing the collective pitch to establish a descent. Airspeed should be controlled by the cyclic stick throughout the descent. The rate of descent is controlled by proper application of power and collective pitch.

CAUTION

When increasing approach angle, avoid a vertical descent or conditions that would cause power settling.

2–71. During the final stages of the approach, collective pitch should be increased and the cyclic stick adjusted to maintain the originally established glide angle in a manner which will reduce the rate of descent to zero at the time the hovering altitude is reached. (Refer to paragraph 2–75 and figure 2–9.)

CAUTION

Never reduce forward ground speed to zero before reaching hovering altitude.

If landing spot has been overshot, execute a go around immediately.

2–72. DOWNWIND APPROACH. The downwind approach is not recommended, but may be required to accomplish a landing in a restricted or obstructed area. When objects on the approach are exceptionally high, and would require a very steep or vertical approach, the downwind approach may prove more desirable. This approach will depend on wind velocity and obstructions.

2–73. SHALLOW APPROACH. The shallow approach is very effective for operating with heavy gross weight and/or high altitude (low air density) and is the recommended approach for a rolling landing. The tail wheel should be locked and a shallow approach established at an airspeed of 60 to 70 knots. Maintain a shallow rate of descent and gradually decrease airspeed to approximately 10 to 15 knots supplementing the loss of translational lift by increasing collective pitch until touchdown. (Refer to paragraph 2–81.)

2–74. LANDING PROCEDURES.

CAUTION

As collective pitch is decreased after landing, torque will decrease rapidly, tending to swing the nose of helicopter to left. Apply sufficient pressure on right tail rotor pedal to prevent turning.

THIS DIAGRAM ILLUSTRATES A TYPICAL APPROACH AND LANDING IN AN UNOBSTRUCTED AREA

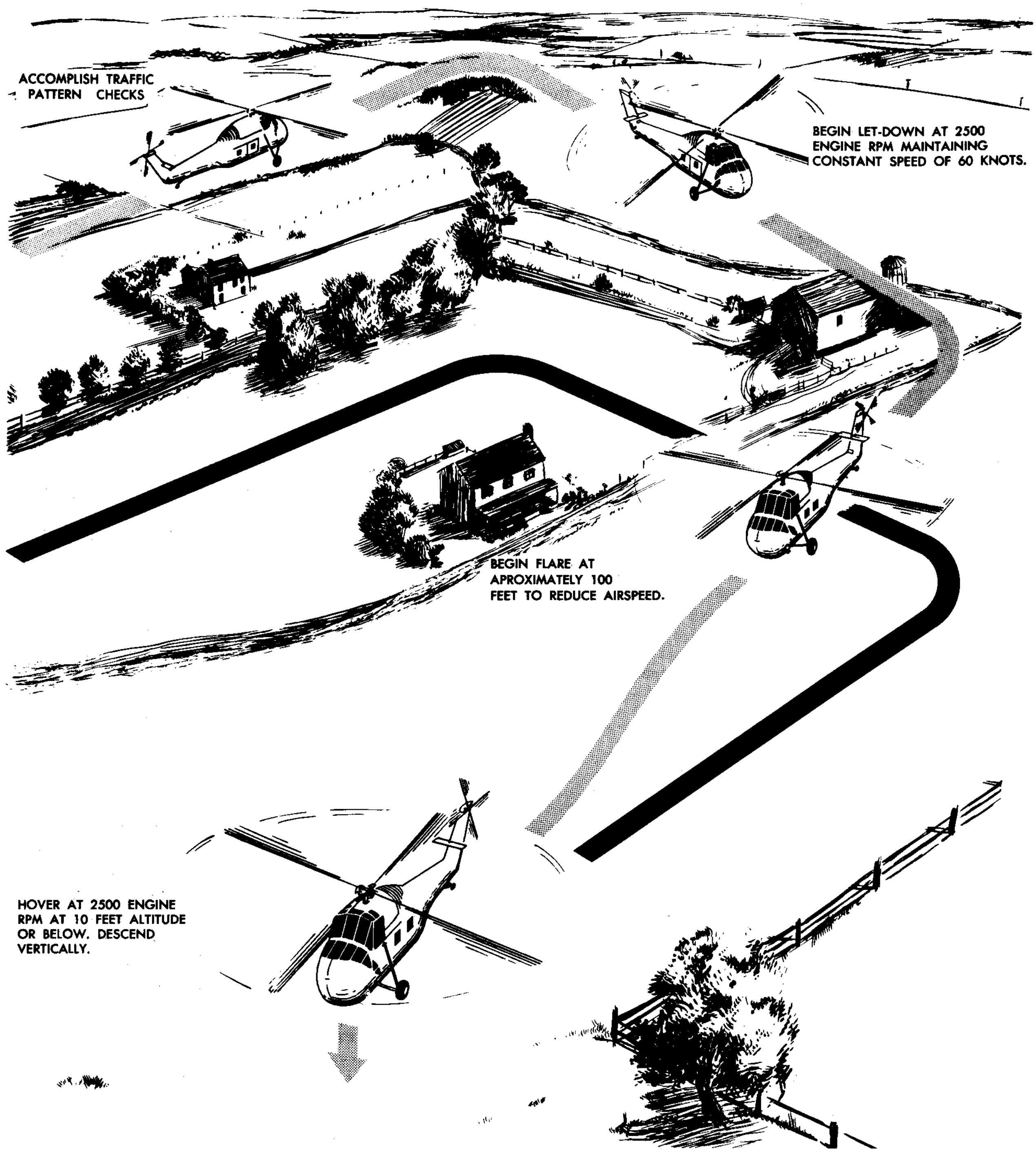


Figure 2–9. Power On Landing

CAUTION

Use tail rotor pedals cautiously. Helicopter has a tendency to swerve during ground operation due to aft location of full-swiveling tail wheel and high power developed by tail rotor.

2-75. NORMAL LANDING FROM A HOVER PROCEDURE. Attain a hovering attitude approximately 5 to 10 feet above the ground, and then decrease collective pitch slightly for vertical descent maintaining a minimum of 2500 engine rpm.

Note

Higher rpm is not recommended unless loading and atmospheric conditions warrant it.

2-76. A constant heading and a level attitude should be maintained with the flight controls until ground contact. Upon ground contact, maintain a minimum of 2500 engine rpm while smoothly reducing collective pitch to almost minimum to allow the helicopter to settle without delay to the static position of the oleo struts. This will minimize the possibility of tipping over or of encountering ground resonance. (Refer to paragraph 3-45, Chapter 8.)

WARNING

If ground resonance is encountered at this point, immediately increase collective pitch and take off.

2-77. Maintain 2400 to 2500 engine rpm for taxiing, or reduce engine rpm for engine shutdown.

WARNING

If ground resonance is encountered after reducing engine rpm, immediately reduce collective pitch and throttle and apply both rotor brake and wheel brakes.

2-78. CROSSWIND LANDING PROCEDURE. Crosswind landings can generally be avoided in helicopter operations. Occasionally, plowed, furrowed, or eroded fields and narrow mountain ridges may require that crosswind landings be made. The crosswind landing, in such instances where terrain features dictate, is utilized to prevent landing at a high tipping angle or dangerous tail low attitude; crosswind landings may also be accomplished on smooth terrain when deemed advisable by the pilot. The following procedures should be observed in accomplishing crosswind landings:

2-79. ROUGH OR IRREGULAR TERRAIN. The parking brake handle and the tail wheel handle should be placed in the LOCKED position prior to touchdown. The helicopter should be hovered in the crosswind with a minimum of 2500 engine rpm and no side drift. A normal vertical landing from a hover should be made. Upon ground contact, maintain a minimum of 2500 engine rpm while smoothly reducing collective pitch to almost minimum to allow the helicopter to settle without delay to the static position of the oleo struts. This will minimize the possibility of tipping over or of encountering ground resonance. (Refer to paragraph 3-45, Chapter 8.)

WARNING

If ground resonance is encountered at this point, immediately increase collective pitch and take off.

During all landings maintain 2500 engine rpm until it is determined that the wheels are on firm solid ground. If the wheels should start to settle, a quick takeoff may be accomplished by increasing collective pitch while maintaining 2500 engine rpm.

2-80. After landing, continue to hold the cyclic stick into the wind until engine rpm is reduced for taxiing or until the engine is stopped and the rotor brake applied. Use tail rotor pedals cautiously to prevent swerving after touchdown.

WARNING

If ground resonance is encountered after reducing engine rpm, immediately reduce collective pitch and throttle and apply both rotor brake and wheel brakes.

2-81. ROLLING LANDING PROCEDURE. The rolling landing procedure is usually accomplished from a shallow approach when the helicopter cannot be hovered, due to a high gross weight or high altitude. When operating under these conditions, it is necessary to maintain the additional lift provided by forward motion until the wheels are on the ground. Prior to attempting a rolling landing, the surface should be checked from low altitude at a reduced airspeed to determine the feasibility of accomplishing the landing. The selected landing site should be of smooth surface.

CAUTION

To prevent tail of helicopter from swerving, tail wheel should be locked.

Rolling landings should not be attempted over rough terrain.

2–82. Decrease collective pitch and maintain 2500 engine rpm. A level flight attitude should be maintained as well as a straight track over the ground. With the use of the collective pitch lever and the cyclic stick, maintain a shallow approach with a slow rate of descent.

CAUTION

All side drift in respect to the surface should be eliminated before touchdown.

2–83. As the helicopter approaches the ground, a slight increase in collective pitch may be necessary to slow the rate of descent and establish a landing attitude while reducing airspeed to a minimum.

Note

Minimum airspeed will depend on gross weight and atmospheric conditions.

2–84. As the wheels contact the ground, move the cyclic stick slightly forward of the neutral position and decrease collective pitch to a minimum to allow the helicopter to settle without delay to the static position of the oleo struts. This will minimize the possibility of tipping over or of encountering ground resonance. (Refer to paragraph 3–45, Chapter 8.)

WARNING

If ground resonance is encountered, immediately increase collective pitch and take off. If takeoff cannot be accomplished, immediately reduce collective pitch and throttle and apply both rotor brake and wheel brakes.

2–85. Stop the helicopter with a slight aft displacement of cyclic stick and with the wheel brakes. Until the helicopter is stopped, maintain 2500 engine rpm and directional control with the tail rotor pedals.

WARNING

There is a tendency to apply aft cyclic stick as contact with ground is anticipated and immediately after landing. Excessive aft displacement of cyclic stick prior to landing will result in a dangerously nose-high landing attitude which may either result in tail wheel striking ground or cause main rotor blades to strike tail cone. Immediately after touchdown, cyclic stick should be moved slightly forward of neutral position. This will place weight on main wheels and eliminate possibility of tipping main rotor blades into tail cone.

2–86. Reduce engine rpm for engine shutdown.

2–87. GO-AROUND.

2–88. If it is necessary to perform a go-around, increase throttle and collective pitch lever to maximum power maintaining 60 knots airspeed and establish a climb.

2–89. AFTER LANDING.

a. Tail wheel lock handle – AS REQUIRED.

b. Parking brake handle – AS REQUIRED.

c. Collective pitch lever – AS DESIRED (FOR TAXIING).

d. Carburetor air lever – DIRECT.

e. Rotating anti-collision light – OFF.

f. Cyclic stick – HOLD INTO WIND WHILE TAXIING.

g. Tail rotor pedals – MAINTAIN HEADING WHILE TAXIING.

Note

Head helicopter into wind prior to parking and engine shutdown.

h. Tail wheel lock handle – LOCKED.

i. Parking brake handle – LOCKED.

j. ASE standby button – DEPRESS. Allow a few seconds for the servo motors to drive to the null position.

2–90. POST FLIGHT ENGINE CHECK.

2–91. This check shall be accomplished after flight is complete. Any unsatisfactory conditions should be reported on the appropriate forms.

a. Ignition system – CHECK. Accomplish at 2200 engine rpm and 25 inches Hg manifold pressure. Maximum drop on either left or right magneto position is 75 engine rpm.

Note

If an unacceptable magneto check occurs, refer to paragraph 2–8, Chapter 9.

b. Freewheeling unit – CHECK. Accomplish at 2200 engine rpm. Decrease throttle rapidly enough to split rotor and engine tachometer needles momentarily to check operation of freewheeling unit. Increase throttle to rejoin needles above 1500 engine rpm.

WARNING

If the tachometer needles do not split readily or if rotor rpm decreases as rapidly as engine rpm, freewheeling unit is malfunctioning.

c. Throttle – CLOSED.

d. Droop stops – IN PLACE.

CAUTION

Droop stop malfunctioning can be detected by observing main rotor blades. A low blade indicates that droop stop is not in place. When this condition is noted, rotor rpm should be increased immediately. After rotor is fully engaged, actuate collective pitch lever slightly to lift blade. Close throttle and repeat droop stop check. When a droop stop cannot be properly positioned, cyclic stick should be held in approximately neutral position as rotor rpm diminishes.

If it becomes necessary to run engine on ground for an extended period after disengaging main rotor, engine speed should be limited to a maximum of 1400 rpm to prevent overheating clutch. External power should be connected to provide electrical power for helicopter.

e. Idle speed – CHECK. Engine should idle at 1000 rpm (±100 rpm) with throttle closed.

f. Rotor – CHECK DISENGAGED.

g. Rotor brake lever – ON. Gradually move rotor brake lever forward to full ON position and lock. Do not pump rotor brake lever.

h. Rotor brake warning light – ON.

i. Ignition switch – CHECK. Accomplish at 1000 rpm (±100 rpm). Turn ignition switch OFF momentarily and observe that engine completely ceases firing.

CAUTION

Perform check as rapidly as possible to prevent backfire and possible damage to induction system.

j. Idle mixture – CHECK.

Note

Refer to table 2–1 for idle mixture check. Minimum cylinder head temperature for accomplishing the idle mixture check is 125°C.

TABLE 2–1
IDLE MIXTURE CHECK

Press the engine primer button and note any momentary change in manifold pressure and rpm. Refer to table below for proper mixture.

MANIFOLD PRESSURE	RPM	MIXTURE
Decreases	Increases	Too lean
Increases	Decreases	Either too rich or correct at best power.

To determine if mixture is correct at best power or too rich slowly move mixture lever toward IDLE CUT-OFF until a change in manifold pressure and rpm is noted. Refer to table below for proper mixture.

MANIFOLD PRESSURE	RPM	MIXTURE
Decreases	Increases	Too rich
Increases	Decreases	Correct at best power.

2–92. ENGINE SHUTDOWN.

Note

If post flight engine check (paragraph 2–90) has been completed, start with step *d.*

a. Throttle – CLOSED. Idle engine at approximately 1000 rpm (±100 rpm) so that cylinder head temperature stabilizes at 150°C or a value consistent with existing atmospheric temperature. Engine should be idled for at least 1 minute to insure optimum oil system scavenging.

b. Rotor brake lever – ON. Gradually move lever forward to the full ON position and lock. Do not pump rotor brake lever.

Note

During turbulent or gusty wind conditions, rotor should be stopped as rapidly as possible to prevent excessive flapping of main rotor blades. To stop rotors, apply rotor brake gradually when rotor speed drops below 80 rpm.

CAUTION

Do not momentarily increase collective pitch to slow rotor speed. A gust of wind may pick up a blade at high pitch and then drop it low enough to strike tail cone.

c. Rotor brake warning light – ON.

Note

If oil dilution is required, refer to paragraph 3–10, Chapter 10.

d. Mixture lever – IDLE CUT-OFF.

Note

If IDLE CUT-OFF position does not stop engine, turn ignition switch OFF and slowly open throttle as engine cuts out. Note condition on DA Form 2408.

e. Ignition switch – OFF (AFTER ENGINE STOPS).

f. Fuel flow selector valve handle – OFF.

g. Fuel transfer pump switches – OFF.

h. Fuel booster pump switch – OFF.

2–93. BEFORE LEAVING THE HELICOPTER.

a. Radio switches – OFF.

b. Electrical switches – OFF (EXCEPT STICK TRIM AND GENERATOR SWITCHES).

c. DA Form 2408 – COMPLETED.

WARNING

Make appropriate entries on DA Form 2408 covering any limits in the OPERATOR'S MANUAL which have been exceeded during flight. (Entries must also be made when, in the pilot's judgment, helicopter has been exposed to unusual or excessive operations.)

d. Wheel chocks – IN PLACE.

e. Parking brake handle – RELEASE.

CHAPTER 4
EMERGENCY PROCEDURES

SECTION I
SCOPE

1–1. GENERAL.

1–2. This chapter covers in detail the procedures to be followed in meeting emergencies (except those associated with the auxiliary equipment) that can reasonably be expected to be encountered.

1–3. Emergency operation of the auxiliary equipment will be included in this chapter only if it affects the safety of flight. All other emergency operation of auxiliary equipment is covered in Chapter 6. Emergency systems and equipment are described in Chapters 2 and 6.

SECTION II

ENGINE

2-1. ENGINE FAILURE.

2-2. Engine failure requires immediate action if a safe power-off landing is to be accomplished. The varied conditions under which engine failure may occur preclude dictating a standard procedure to be followed. However, a thorough knowledge of the helicopter's characteristics and emergency procedures will enable a pilot to automatically and correctly respond to the emergency. The proper use of the checklist should eliminate the possibility of operating the helicopter with any known marginal mechanical deficiency. The altitude and airspeed at which engine failure occurs will dictate the action to be taken to effect a safe landing. Should engine failure occur, a safe autorotative landing can be made, except when operating at low altitude and with the airspeeds shown on chart 2-I, Chapter 7. Immediately upon engine failure, the helicopter will swing to the left. This is due to the reduction in torque as engine power decreases. Tail rotor thrust should be decreased by depressing the right tail rotor pedal to maintain the same heading. A reduction in rotor rpm as well as in engine rpm will occur, as the main rotor will not autorotate until collective pitch is reduced to almost minimum.

Note

In event of engine failure, the automatic stabilization equipment and the auxiliary servo system will become inoperative as the auxiliary servo hydraulic pump is driven by the engine.

2-3. ENGINE FAILURE ON TAKEOFF.

2-4. Engine failure on takeoff in a helicopter can occur under various altitude and airspeed conditions which dictate the procedure to be followed. These factors, coupled with the conditions existing at the operating site, preclude the possibility of establishing other than general safe practices which must be observed if a safe power-off landing is to be accomplished.

2-5. ENGINE FAILURE DURING TAKEOFF OR WHILE HOVERING BELOW 10 FEET.

2-6. Settling will be so rapid under these conditions that little can be done to avoid a hard landing.

a. Collective pitch lever – INCREASE. Landing may be cushioned somewhat by increasing collective pitch as helicopter settles to ground. Do not reduce collective pitch in case of engine failure. In this case, a reduction of pitch would cause helicopter to settle rapidly.

b. Cyclic stick – MAINTAIN LEVEL ATTITUDE. Damage to helicopter will be less if it strikes ground in a level attitude.

c. Cyclic stick – SLIGHTLY FORWARD WHEN ON GROUND.

d. Collective pitch lever – MINIMUM.

e. Brake pedals – DEPRESS.

f. Rotor brake lever – ON.

g. Battery switch – OFF.

Note

Any displacement of cyclic stick aft of neutral will decrease main rotor blade-tail cone clearance and increase possibility of striking tail cone with a main rotor blade.

2-7. ENGINE FAILURE DURING INITIAL CLIMB.

2-8. After the climb has been started, various techniques may be employed to execute a power-off landing. Power-off (autorotative) approach and landing are shown in figure 2-1. When engine failure is experienced, proceed as follows:

a. Collective pitch lever – MINIMUM. Establish a glide at 60 knots when altitude permits.

b. Cabin occupants – ALERTED.

c. Battery switch – OFF.

d. Generator switch – OFF.

e. Fuel booster pump switch – OFF.

f. Fuel flow selector valve handle – OFF.

g. Ignition switch – OFF.

h. Shoulder harness inertia reel lock lever – LOCKED.

THIS DIAGRAM ILLUSTRATES A TYPICAL POWER-OFF APPROACH AND LANDING IN AN UNOBSTRUCTED AREA

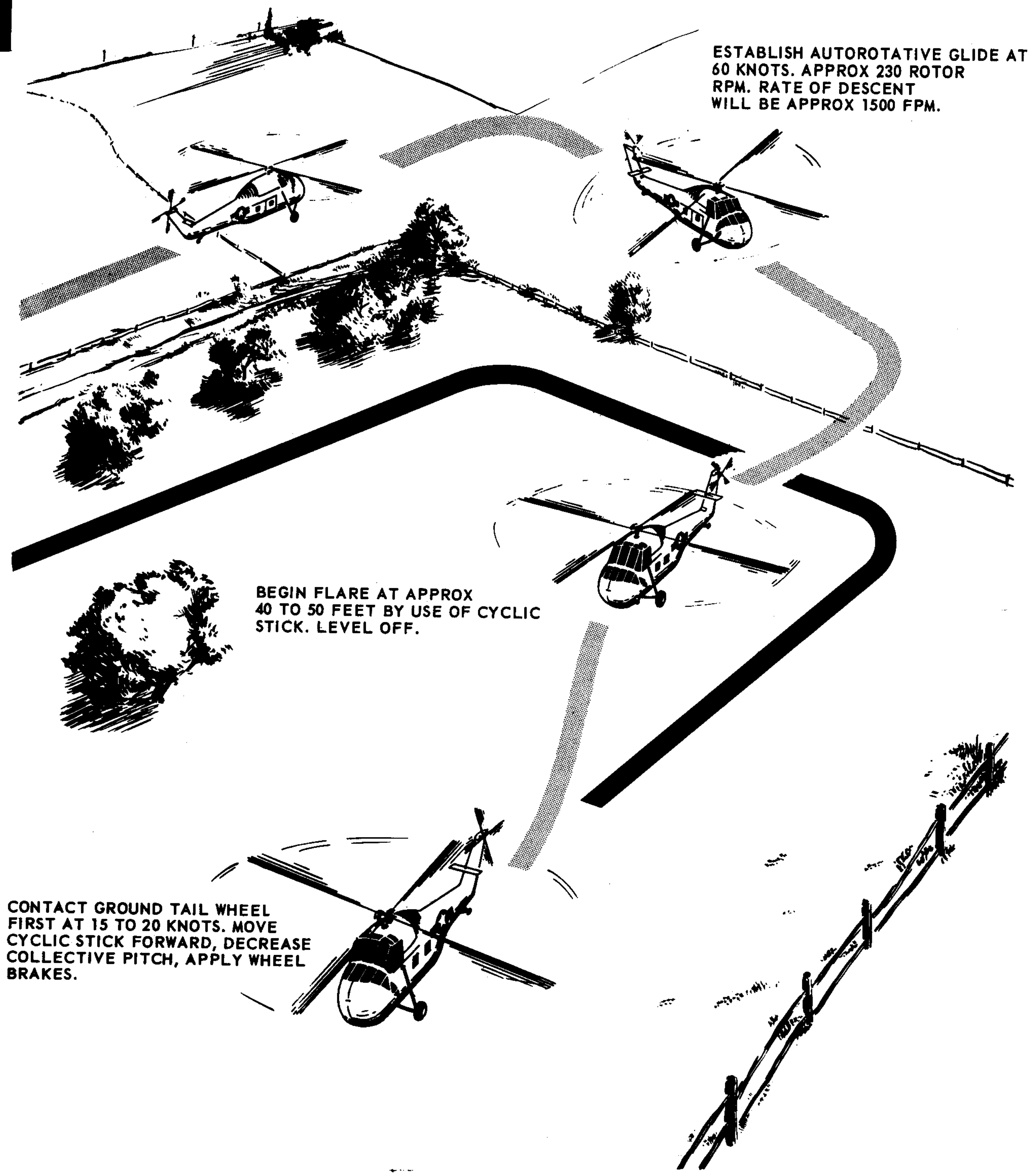


Figure 2-1. Autorotative Landings

2–9. ENGINE FAILURE DURING FLIGHT. (See figure 2–1.)

2–10. In event of engine failure during flight, a safe autorotative landing can be accomplished, provided the helicopter is being flown at a safe altitude – airspeed combination, and the inflight altitude is sufficient to permit selection of a suitable landing area. When altitude permits, an air restart should be attempted. If the engine fails to start, a normal power-off autorotative landing should be accomplished, as covered in paragraph 2–18. Power-off (autorotative) approach and landing are shown in figure 2–1.

a. Collective pitch lever–DECREASE. Establish an autorotative glide at approximately 60 knots and 230 rotor rpm (equivalent to 2600 rpm on engine scale).

b. Throttle – CLOSED.

c. Cabin occupants – ALERTED.

d. All engine switches – OFF.

Note

If time and altitude permit, try to restart engine. It will be left to pilot's judgment whether to attempt to start engine or to make a power-off landing. If an attempt to start engine is made, proceed as follows:

2–11. RESTARTING ENGINE IN FLIGHT.

2–12. An inflight engine restart may become necessary in the event of fuel starvation as a result of fuel pump failure. The helicopter, in a normal autorotation with 60 knots airspeed and approximately 230 rotor rpm (equivalent to 2600 rpm on engine scale), descends at approximately 1500 fpm. Altitude, gross weight, and air density vary autorotative rpm. The altitude at which an air restart can be safely accomplished depends on the individual pilot and crew proficiency. The high degree of proficiency required to accomplish any emergency procedure can only be attained by continuous training, practice, and drill. Engine failure in the helicopter requires the pilot to immediately establish an autorotative approach for a power-off landing. It is necessary that the following be accomplished:

a. Collective pitch lever – MINIMUM.

b. Throttle – CLOSED.

c. Mixture lever – IDLE CUT-OFF.

d. Fuel booster pump switch – FUEL BSTR PUMP.

e. Fuel flow selector valve handle – ON.

f. Fuel transfer pump switches – AFT OR CTR.

g. Starter button – DEPRESS.

h. Ignition switch – BOTH (AFTER ENGINE HAS TURNED FOR 3 SECONDS).

i. Engine primer button – DEPRESS.

j. Mixture lever – RICH (SOON AS ENGINE STARTS).

k. Throttle – INCREASE. As engine fires, increase to appropriate rpm.

2–13. If attempts to start the engine fail, accomplish the following procedure:

2–14. ENGINE SHUTDOWN IN FLIGHT.

a. Throttle – CLOSED.

b. Mixture lever – IDLE CUT-OFF.

c. Fuel booster pump switch – OFF.

d. Ignition switch – OFF.

e. Fuel flow selector valve handle – OFF.

f. Fuel transfer pump switches – OFF.

g. Cabin heater switch – OFF.

h. Shoulder harness inertia reel lock lever – LOCKED.

2–15. MAXIMUM AUTOROTATIVE GLIDE. (See chart 2–I.)

2–16. The maximum autorotative rate of descent, approximately 1500 feet per minute, is obtained at 60 knots airspeed and approximately 230 rotor rpm (equivalent to 2600 rpm on engine scale).

2–17. Maximum autorotative gliding distance is obtained at 80 knots airspeed and approximately 220 rotor rpm (equivalent to 2480 rpm on engine scale). Increases of rotor rpm above these values result in a greater rate of descent, resulting in reduced gliding distances.

2–18. LANDING WITH ENGINE INOPERATIVE.

2–19. Power-off autorotative landings may be safely accomplished, except when operating at low altitude and at a low airspeed.

2–20. POWER-OFF AUTOROTATIVE APPROACH AND LANDING. (See figure 2–1.)

a. Collective pitch lever – DECREASE.

b. Cyclic stick – FORWARD. Establish stick at a minimum of 60 knots airspeed.

c. Collective pitch lever – ADJUST. Maintain 230 rotor rpm (equivalent to 2600 rpm on engine scale).

220 ROTOR RPM 80 KNOTS INDICATED AIRSPEED

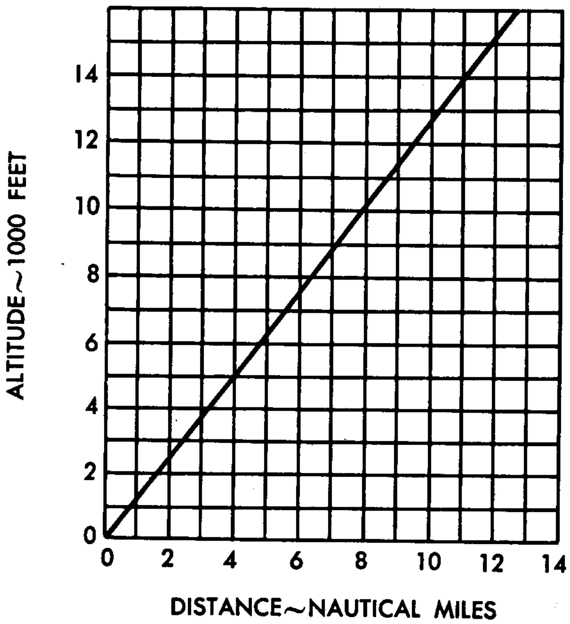


Chart 2–1. Maximum Autorotative Gliding Distance

Note

Control rotor rpm by increasing or decreasing collective pitch.

d. Tail wheel lock handle – LOCKED.

e. Cyclic stick – AFT. At approximately 50 feet, execute a partial flare by moving cyclic stick back with no change in collective pitch. This will reduce airspeed and rate of descent and will cause increase in rotor rpm.

f. Cyclic stick – FORWARD. After airspeed has decreased to approximately 15 to 20 knots, ease cyclic stick forward.

g. Collective pitch lever – INCREASE. Gradually increase collective pitch as helicopter settles and ground contact is made. Ground contact should be made tail wheel first.

CAUTION

After flare and during the final phase of an autorotative landing, all drift must be eliminated prior to touchdown. After landing, directional control is maintained by proper application of wheel brakes.

Note

Desired ground contact speed is 15 to 20 knots.

b. Cyclic stick – FORWARD. Upon ground contact, move the cyclic stick slightly forward of neutral.

i. Collective pitch lever – DECREASE. Decrease collective pitch smoothly and slowly immediately after ground contact.

j. Brake pedals – DEPRESS. Apply wheel brakes cautiously to prevent nosing over.

2–21. LANDING IN TREES. A power-off landing into a heavily wooded area can be accomplished by executing a normal autorotative approach and full flare. The flare should be executed to reach zero rate of descent and zero ground speed as close to the top of trees as possible. As the helicopter settles, increase collective pitch to maximum and allow the helicopter to descend vertically through the trees.

2–22. PRACTICE AUTOROTATIVE LANDINGS.

2–23. Practice autorotative landings may be safely accomplished; however, they should not be attempted with the airspeed and altitude conditions that are within the shaded area of chart 2-I, Chapter 7. The procedure for practicing autorotative landings is as follows:

a. Collective pitch lever – DECREASE. Steadily decrease collective pitch, maintaining 2600 engine rpm. As torque decreases, increase pressure on right tail rotor pedal.

b. Throttle – 2000 ENGINE RPM.

c. Airspeed – 60 KNOTS MINIMUM. Establish glide at 70 to 80 knots airspeed, maintaining 230 rotor rpm (equivalent to 2600 rpm on engine scale).

d. Mixture lever – RICH.

e. Carburetor air lever – CLIMATIC.

f. Fuel booster pump switch – FUEL BSTR PUMP.

g. Cyclic stick – AFT. Begin flare at approximately 40 to 50 feet by moving cyclic stick back with no change in collective pitch lever.

Note

Control main rotor rpm by increasing or decreasing collective pitch.

b. Cyclic stick – FORWARD. Level off by easing cyclic stick forward when airspeed and rate of descent have decreased to desired amount.

i. Collective pitch lever – INCREASE. Gradually increase collective pitch.

j. Throttle – 2500 ENGINE RPM. Apply power to hover with 2500 rpm at 10-foot altitude or above.

Note

Steps *i* and *j* should be accomplished simultaneously. Establish a climb, maintaining the power settings in table 2–V, Chapter 14.

NOTE
AS COLLECTIVE PITCH IS INCREASED, THE HELICOPTER WILL HAVE A TENDENCY TO SWING TO THE RIGHT WHICH SHOULD BE COUNTERACTED BY ADDITIONAL PRESSURE ON THE LEFT TAIL ROTOR PEDAL.

THE TAKEOFF SHOULD BE VERTICAL TO APPROXIMATELY 5 FEET OR TO A SUFFICIENT HEIGHT TO PREVENT THE WHEELS FROM CONTACTING THE GROUND WHILE MANEUVERING.

PARKING BRAKE HANDLE – OFF.
TAIL WHEEL LOCK HANDLE – AS DESIRED.
COLLECTIVE PITCH LEVER – MINIMUM PITCH.
THROTTLE – ADVANCE TO MAXIMUM RPM.
COLLECTIVE PITCH LEVER – INCREASE PITCH STEADILY AS THE HELICOPTER LEAVES THE GROUND. MAINTAIN MAXIMUM RPM WITH THROTTLE.
MAINTAIN DIRECTIONAL CONTROL WITH THE TAIL ROTOR PEDALS.

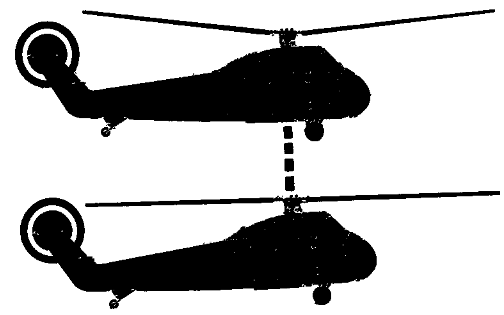


Figure 2–5. Normal Takeoff to a Hover (Typical)

AS THE HELICOPTER BECOMES AIRBORNE, MOVE THE CYCLIC STICK FORWARD TO ACCELERATE INTO FORWARD FLIGHT WHILE ESTABLISHING A CLIMB. A SAFE AUTOROTATIVE AIRSPEED OF APPROXIMATELY 60 KNOTS SHOULD BE OBTAINED AS SOON AS POSSIBLE. MAINTAIN HEADING BY USE OF TAIL ROTOR PEDALS.

NOTE
EXCESSIVE USE OF THE LEFT TAIL ROTOR PEDAL CREATES AN ADDITIONAL LOAD ON THE ENGINE, RESULTING IN A DECREASE OF AVAILABLE POWER TO THE MAIN ROTOR.

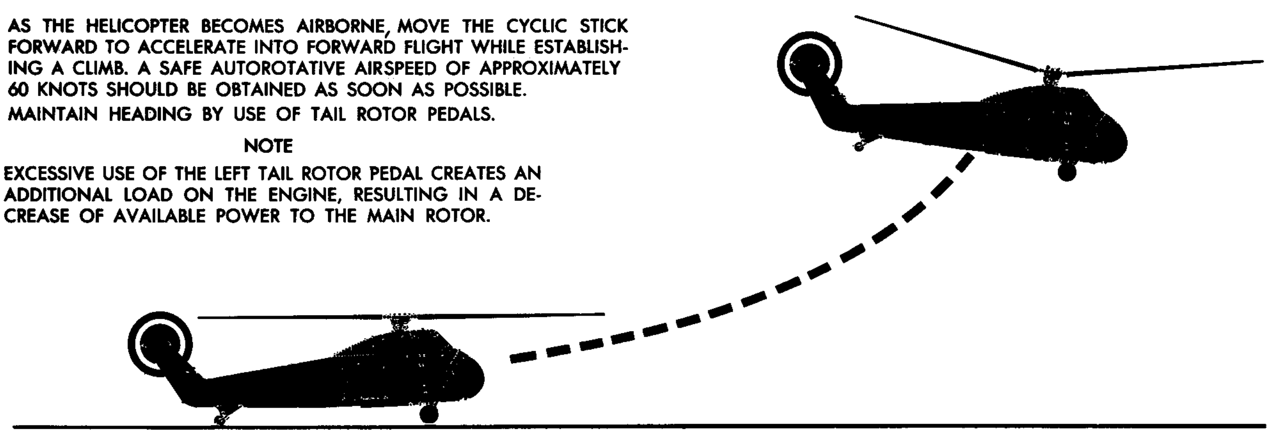


Figure 2–6. Normal Takeoff Without a Hover (Typical)

Note

This technique will produce the results given in Chapter 14.

2–38. NORMAL TAKEOFF WITHOUT A HOVER. (See figure 2–6.) The primary objective of the normal takeoff without a hover is to accelerate the helicopter from a standing position into forward flight as rapidly as possible. This can be accomplished by placing the cyclic stick slightly forward of neutral, at the same time gradually increasing collective pitch and maintaining directional control with tail rotor pedals. As the helicopter leaves the ground, accelerate forward by smoothly lowering the nose of the helicopter to an attitude that will result in an increase of airspeed to 60 knots. Adjust power as required to attain normal climb.

2–39. MAXIMUM PERFORMANCE TAKEOFF. (See figure 2–7.) Maximum performance takeoffs enable the helicopter to take off from a restricted or mountainous area under various weights and atmospheric conditions. Maximum performance takeoffs can be accomplished by placing the cyclic stick in a neutral position, increasing throttle to maximum engine rpm and increasing collective pitch smoothly, maintaining maximum rpm. As the helicopter leaves the ground, continue to increase

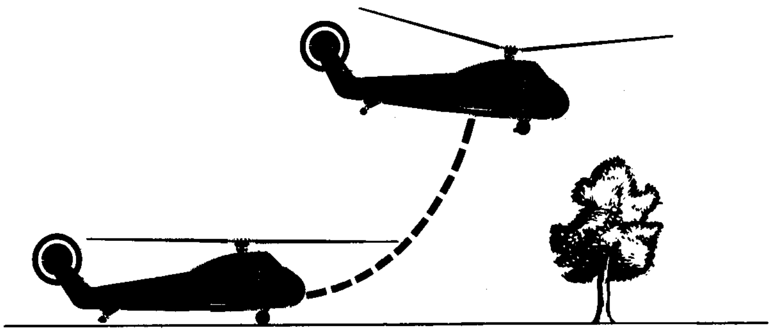


Figure 2–7. Maximum Performance Takeoff (Typical)

power and collective pitch to maintain maximum rpm assuming an attitude that will result in maximum rate of climb. Maintain directional control with tail rotor pedals as power is increased until the obstacle is cleared and smoothly reduce power and increase airspeed to establish a normal climb.

2–40. ROLLING TAKEOFF. (See figure 2–8.) Under certain conditions of high gross weight and low air density, there may not be sufficient power developed by the engine nor lift developed by the main rotor blades to accomplish a normal takeoff. Under these conditions, it is necessary to develop lift through forward motion prior to becoming airborne by using a rolling takeoff. A thorough study of the terrain should be made to determine that a rolling takeoff is feasible. The primary objective in the rolling takeoff is to accelerate the helicopter rapidly while on the ground, thereby taking advantage of the lift developed due to forward motion to accomplish the takeoff.

CAUTION

Rolling takeoffs should not be attempted over rough terrain due to the possibility of damage to the helicopter resulting from main rotor blade flexing.

2–41. CROSSWIND TAKEOFF. In the event a crosswind takeoff is required, normal takeoff procedures are used. As the helicopter leaves the ground, there will be a definite tendency to drift downwind. This tendency can be corrected by holding the cyclic stick into the wind a sufficient amount to prevent downwind drift. The large surface area of the tail cone and pylon will tend to weathercock the helicopter into the wind. When a crosswind takeoff is required, it is more desirable to make the takeoff with the left side of the helicopter upwind. This will eliminate the additional engine load caused by the use of left tail rotor pedal. When a crosswind takeoff is accomplished, it is advisable to turn the helicopter into the wind for climb as soon as obstacles are cleared and terrain permits.

2–42. AFTER TAKEOFF.

a. Instruments – CHECK.

b. Carburetor air lever – CLIMATIC.

c. Mixture lever – NORMAL.

Note

NORMAL position of mixture lever may be used for all power settings up to and including military rated power as long as cylinder head temperature remains within normal limits. When operating at military rated power, cylinder head temperature is permissible up to red line temperature for 30 minutes. During operations at low altitude, RICH position of mixture lever may be used.

d. Fuel booster pump switch – OFF (ABOVE 2000 FEET). Place fuel booster pump switch OFF above 2000 feet unless fuel pressure drops below normal operating range or if fuel pressure instability is experienced.

Note

Fuel booster pump should be kept on for all operations below 2000 feet.

SECTION III
FIRES

3-1. FIRE. (See chart 3-1.)

3-2. ENGINE FIRE WHILE STARTING.

3-3. If an engine fire should develop while starting, it may be detected visually by the fire guard or by the fire detector warning light located on the main switch panel. The starting procedure should be continued.

Note

If engine does not start and the fire is not drawn into the induction system or blown out, proceed as follows:

a. Mixture lever – IDLE CUT-OFF.

b. Fuel booster pump switch – OFF.

c. Fuel flow selector valve handle – OFF.

d. Fuel transfer pump switches – OFF.

e. Ignition switch – OFF.

f. All electrical switches – OFF.

WARNING

Do not open engine access doors, but fight fire through engine cooling air exits. Do not attempt to restart engine until a thorough check for damage is completed and engine is inspected and approved for operation.

3-4. ENGINE FIRE ON GROUND AFTER STARTING.

3-5. If an engine fire should occur after the engine is started, the throttle should be gradually opened in an attempt to draw the fire into the induction system. If the fire cannot be drawn into the induction system, proceed as follows:

a. Mixture lever – IDLE CUT-OFF.

b. Fuel booster pump switch – OFF.

c. Fuel flow selector valve handle – OFF.

d. Fuel transfer pump switches – OFF.

e. Ignition switch – OFF.

f. All electrical switches – OFF.

WARNING

Do not open engine access doors, but fight fire through engine cooling air exits. Do not attempt to restart engine until a thorough check for damage is completed and engine is inspected and approved for operation.

3-6. ENGINE FIRE IN FLIGHT.

3-7. Engine fires are usually the result of an engine malfunction or failure of one of its component systems. Ruptured fuel and oil lines will usually be detected by engine instrument indications. Most engine fires are fed by fuel or oil, and the first step is to shut off the system which is causing the fire. The color of the smoke may help to identify the kind of fire. Black smoke comes from a fuel fire; bluish white smoke from engine oil; white smoke from hydraulic oil. However, engine flame and smoke identification alone is of little value in fighting a fire. As the helicopter does not have an engine fire extinguisher installed in the engine compartment, the procedures to be followed will depend on the severeness of the fire. It will be left to the pilot's judgment whether crew and passengers should bail out or if they should prepare for an autorotative landing.

3-8. Bailout procedure is covered in paragraph 5-15. If an autorotative landing is to be made, slipping the helicopter or sideward flight during glide may keep the flames from entering the pilots' compartment. Normal autorotative landings are covered in paragraph 2-18. In addition to this procedure, comply with the following after an autorotative glide is established:

a. Collective pitch lever – MINIMUM. Establish autorotative glide.

b. Throttle – CLOSED.

c. Cabin occupants – ALERTED.

d. Mixture lever – IDLE CUT-OFF.

e. Fuel booster pump switch – OFF.

f. Fuel flow selector valve handle – OFF.

g. Fuel transfer pump switches – OFF.

VARIOUS ENGINE MALFUNCTIONS ARE OFTEN INDICATED BY CHARACTERISTIC SMOKE AND FLAME PATTERNS. THIS CHART IS PROVIDED SO THAT THE FLIGHT CREW MAY MORE ACCURATELY IDENTIFY ENGINE FLAME AND SMOKE CONDITIONS AND KNOW AT ONCE THE CAUSE AND THE REMEDIAL ACTION TO BE UNDERTAKEN.

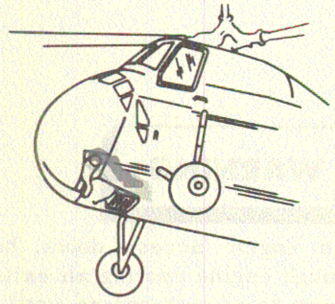
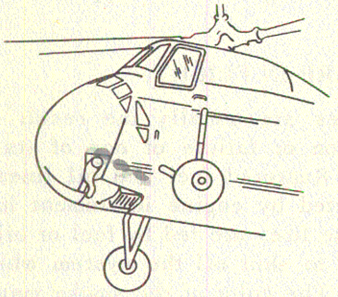
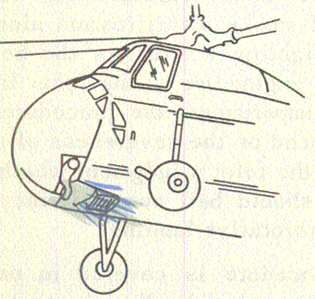
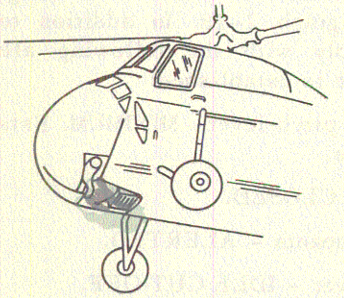
	CAUSE	ACTION
 BLACK SMOKE FROM EXHAUST	USUALLY OCCURS AT HIGH POWER SETTINGS AND INDICATES TOO RICH CARBURETOR MIXTURE. THERE WILL BE NO INSTRUMENT INDICATIONS EXCEPT THAT FUEL WILL BE CONSUMED AT A FASTER RATE THAN NORMAL.	MANUAL LEANING BEYOND NORMAL SHOULD NOT BE ATTEMPTED. REDUCE POWER.
 PUFFS OF BLACK SMOKE FROM EXHAUST	DETONATION, AND/OR BACKFIRE. INDICATED BY ROUGH RUNNING ENGINE, HIGH CYLINDER HEAD TEMPERATURE AND CARBURETOR AIR TEMPERATURE, AND LOSS OF POWER. IF THIS CONDITION CONTINUES, ENGINE FAILURE IS IMMINENT.	ENRICH MIXTURE. REDUCE POWER, MONITOR ENGINE INSTRUMENTS.
 THIN WISPS OF BLUE-GRAY SMOKE FROM ENGINE COOLING AIR EXIT	SLIGHT OIL LEAK. POSSIBILITY OF FIRE EXISTS, BUT NO ACTION NECESSARY UNLESS FIRE DEVELOPS.	WATCH CLOSELY AND LAND AS SOON AS POSSIBLE IF VOLUME OF SMOKE INDICATES THE NECESSITY.
 BLACK SMOKE FROM ENGINE COOLING AIR EXIT	OIL LEAK AND OIL FIRE, POSSIBLY VARIABLE OIL PRESSURE, HIGH CYLINDER HEAD TEMPERATURE, AND ILLUMINATION OF FIRE DETECTOR WARNING LIGHT. AN UNCONTROLLED FIRE MAY DEVELOP.	PERFORM EMERGENCY ENGINE SHUTDOWN PROCEDURE. IF FIRE DOES NOT GO OUT, ALERT CREW, PREPARE TO BAIL OUT OR MAKE AUTOROTATIVE LANDING.

Chart 3-1. Engine Flame and Smoke Identification (Sheet 1 of 2)

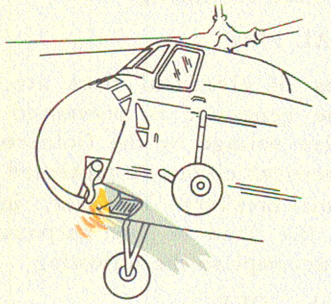
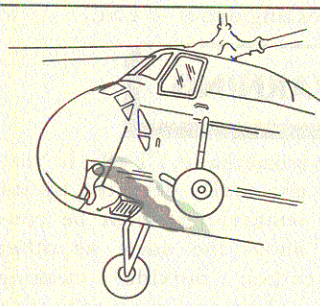
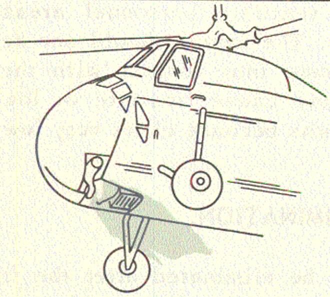
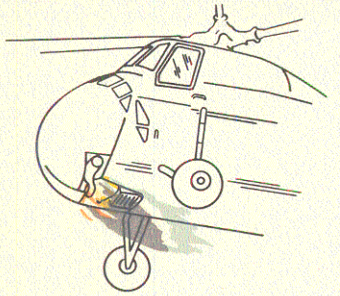
	CAUSE	ACTION
 VARIABLE QUANTITY OF GREY SMOKE AND POSSIBLY LIGHT FLAME FROM ENGINE COOLING AIR EXIT	CYLINDER HEAD OR EXHAUST FAILURE INDICATED BY HIGH CYLINDER HEAD TEMPERATURE, LOSS OF POWER AND POSSIBLE ILLUMINATION OF FIRE DETECTOR WARNING LIGHT. IF THIS CONDITION IS ALLOWED TO CONTINUE, ENGINE FAILURE AND FIRE MAY RESULT.	DEPENDING UPON THE SEVERITY OF THE CONDITION, SHUT DOWN ENGINE, ALERT CREW, AND MAKE AUTOROTATIVE LANDING.
 HEAVY BLACK SMOKE FROM EXHAUST	INITIAL INDUCTION FIRE FROM BURNING FUEL POSSIBLY INDICATED BY HIGH CYLINDER HEAD TEMPERATURE AND A SUDDEN LOSS OF POWER. AN UNCONTROLLED FIRE MAY DEVELOP.	AT THE DISCRETION OF THE PILOT, DEPENDING UPON THE SEVERITY OF THE CONDITION, PILOT AND CREW BAIL OUT, OR SHUT DOWN ENGINE, ALERT CREW, AND MAKE AUTOROTATIVE LANDING.
 DENSE WHITE SMOKE FROM ENGINE COOLING AIR EXIT	INDUCTION FIRE IN ADVANCED STAGE. POSSIBLY VERY HIGH CYLINDER HEAD TEMPERATURE AND CARBURETOR AIR TEMPERATURE, FLUCTUATING ENGINE INSTRUMENTS AND ILLUMINATION OF FIRE DETECTOR WARNING LIGHT. AN UNCONTROLLED FIRE MAY DEVELOP.	FIRE HAS PROGRESSED TO EXTREMELY DANGEROUS STAGE. THERE IS NO REMEDIAL ACTION. ALERT CREW AND PREPARE TO BAIL OUT.
 BLACK SMOKE WITH ORANGE AND YELLOW FLAME FROM ENGINE COOLING AIR EXIT	FUEL LEAK AND FIRE, POSSIBLY VARIABLE FUEL PRESSURE, HIGH CYLINDER HEAD TEMPERATURE, AND ILLUMINATION OF FIRE DETECTOR WARNING LIGHT. AN UNCONTROLLED FIRE MAY DEVELOP.	PERFORM EMERGENCY ENGINE SHUTDOWN PROCEDURE. IF FIRE DOES NOT GO OUT, ALERT CREW, AND PREPARE TO BAIL OUT OR MAKE AUTOROTATIVE LANDING.

Chart 3-1. Engine Flame and Smoke Identification (Sheet 2 of 2)

h. Ignition switch – OFF.

i. Cabin heater switch – OFF.

Note

Flames, due to engine fire, will probably be drawn away from pilots' compartment and other vital components of helicopter by flow of engine cooling air which enters on upper cowling and is blown forward and downward by fan (when engine is operating) through engine cooling air exit.

3–9. FUSELAGE FIRE.

a. Pilots' sliding windows – CLOSED.

b. Cabin door – CLOSED.

c. Cabin vents – CLOSED.

d. Cabin heater switch – OFF.

e. Ventilation fan switch – OFF.

f. Portable fire extinguisher – USE.

WARNING

Monobromotrifluoromethane, CF_3Br is very volatile, but is not easily detected by its odor. Although nontoxic, it must be considered to be about the same as other freons and carbon dioxide, causing danger to personnel primarily by reduction of oxygen available for proper breathing. During operation of the portable fire extinguisher, ventilate personnel areas with fresh air. The liquid should not be allowed to come into contact with the skin, as it may cause frostbite or low temperature burns because of its very low boiling point.

Note

Land as soon as possible. Determine cause of fire before continuing.

3–10. ELECTRICAL FIRE.

3–11. Possibilities of electrical fires are very slight because the generator is prevented from generating excessive voltage by the field control relay and each electrical circuit is protected from overload by circuit breakers. However, in the event of electrical fire, land as soon as possible, but while in flight accomplish the following:

a. Battery switch – OFF.

b. Generator switch – OFF.

c. Portable fire extinguisher – USE.

WARNING

Monobromotrifluoromethane, CF_3Br, is very volatile, but is not easily detected by its odor. Although nontoxic, it must be considered to be about the same as other freons and carbon dioxide, causing danger to personnel primarily by reduction of oxygen available for proper breathing. During operation of the portable fire extinguisher, ventilate personnel areas with fresh air. The liquid should not be allowed to come into contact with the skin, as it may cause frostbite or low temperature burns because of its very low boiling point.

3–12. SMOKE ELIMINATION.

3–13. Smoke may be eliminated after the fire is extinguished by opening the sliding side windows in the pilots' compartment, the cabin door, and the cabin vents.

SECTION IV

AIRCRAFT SYSTEMS

4-1. TRANSMISSION SYSTEM FAILURE.

4-2. Overspeeding of the rotor system imposes a severe overload on the rotor and transmission system. When an overspeed condition occurs, the pilot should note the maximum rotor rpm attained and the duration of the overspeed condition in DA Form 2408. For further information, refer to paragraph 2-12, Chapter 7.

4-3. MAIN GEAR BOX OIL SYSTEM FAILURE.

4-4. If the main gear box oil pressure should drop below 25 psi or if the main gear box oil temperature should go above 120°C in flight, make an immediate landing as the gear box is not receiving proper lubrication. Flight should not be resumed until the cause has been determined and corrected.

4-5. FUEL SYSTEM FAILURE.

4-6. FUEL TRANSFER SYSTEM FAILURE.

4-7. Failure of the fuel transfer system is indicated by illumination of either of the two fuel no-transfer warning lights. Since these lights are actuated by switches which close due to a drop of fuel pressure in the aft or center fuel tank, they will also go on if the tank is empty or if the transfer pump has been shut off by the fuel detector safety switch when the forward tank is flooded. When a fuel no-transfer warning light comes on, check the fuel quantity gage after selecting the proper tank on the fuel quantity selector switch. If the tank is empty, shut off its transfer pump switch; the light will go out.

Note

If aft tank is emptied by fuel transfer system, continue transferring fuel from center tank by turning on center transfer pump. When center tank is emptied, turn off center transfer pump as only fuel available is from forward tank.

4-8. When a no-transfer warning light comes on and the tank in question is not empty, check to see if the fuel transfer overflow warning light is on. If the fuel transfer overflow warning light is on, turn off the fuel transfer pump switch to allow the engine to consume fuel from the forward tank until the overflow warning light goes out. After a few minutes, turn on the fuel transfer pump switch again. If the overflow warning light persists in lighting after turning the transfer pumps off then on again as described above, leave the transfer pump off and turn the fuel flow selector valve handle to EMER ON if it is necessary to use fuel from the aft and center tanks. Turn off the fuel booster pump switch. When a no-transfer warning light comes on and the tank in question is not empty and the forward tank is not overflowing, the loss of pressure is caused by a failure of the transfer pump or its electrical circuit or by a leak in the fuel transfer line. Turn off the transfer pump and place the fuel flow selector valve handle in the EMER ON position if it is necessary to use fuel from that tank. Turn off the fuel booster pump. When the emergency gravity-feed fuel system is in operation, fuel is drained from each tank at an approximately equal rate. The fuel low-level warning light will not give an accurate indication by means of the fuel quantity gage and the fuel quantity selector switch.

Note

Prior to landing, place fuel selector valve handle in ON position and fuel booster pump switch in FUEL BSTR PUMP position to prevent fuel starvation in a nose-high attitude.

4-9. ENGINE-DRIVEN FUEL PUMP FAILURE.

4-10. Should the engine-driven fuel pump fail, the fuel booster pump will supply sufficient fuel pressure for normal engine operation with the fuel flow selector valve handle in the ON position; however, the booster pump will not supply fuel to the engine when operating with the fuel flow selector valve handle in the EMER ON position.

4-11. FUEL BOOSTER PUMP FAILURE.

4-12. Should the fuel booster pump fail, the engine-driven fuel pump will supply sufficient fuel pressure for normal engine operation.

4-13. THROTTLE LINKAGE FAILURE.

4-14. In event of throttle linkage failure, shut off engine by use of the mixture lever and accomplish a power-off autorotative approach and landing.

(Refer to paragraph 2–18.) If sufficient power for flight is available, flight may be continued to a suitable landing area.

4–15. ELECTRICAL POWER SUPPLY SYSTEM FAILURE.

4–16. The helicopter's electrical system is well protected by circuit breakers, which should be checked at the first sign of individual circuit malfunction.

4–17. GENERATOR FAILURE.

4–18. Generator failure is indicated by the lighting of the warning light, marked GEN OFF, and can be due either to a momentary overvoltage condition or malfunctioning of the generator or of its control circuits. When the generator warning light goes on, check that the circuit breaker, marked GEN FIELD, located on the overhead switch panel is set. Place the generator switch momentarily in the RESET position and then return the switch to the ON position. If the generator malfunction was due to a momentary overload, the generator warning light should go out when the generator switch is placed in the ON position. If the generator warning light remains on, the failure is due to other reasons and all electrical equipment connected to the primary bus will operate from the battery. The system is designed to prolong the life of the battery by breaking the circuit to the secondary bus in the event of generator failure. For equipment operating from the primary and secondary busses, see figure 2–19, Chapter 2.

4–19. FLIGHT INSTRUMENT INVERTER SYSTEM FAILURE.

4–20. MAIN INVERTER. Failure of the main inverter is indicated by the lighting of the FLT INST INV warning light, marked FAILURE, and loss of the flight instruments operating on alternating current. When the warning light goes on, check that the main inverter circuit breakers on the overhead switch panel are set. If inverter power is not restored, place the flight instrument inverter switch in the SPARE position and the warning light will go out.

4–21. SPARE INVERTER. Failure of the spare inverter is indicated by the lighting of the flight instrument inverter failure warning light and the loss of the flight instruments operating on alternating current. When the warning light goes on, check that the spare inverter circuit breakers on the overhead switch panel are set. If inverter power is not restored, place the flight instrument inverter switch in the MAIN position. If the main inverter has failed also, there will be a complete loss of all instruments operating on ac power.

Note

During a loss of 115-volt, 400-cycle ac power, which may be caused by switching of inverters, J-2 compass gyro will switch from slow-slave to rapid-slave for 2 to 3 minutes after 115-volt, 400-cycle ac power is returned. During this period of rapid-slave, yaw channel of ASE receives erroneous signals which have a tendency to make helicopter oscillate in its heading. The helicopter can be flown during this 2 to 3-minute period with ASE on by placing feet on tail rotor pedals, thus disengaging yaw channel of ASE.

4–22. ELECTRICAL FAILURE OF CIRCUITS FOR INSTRUMENTS. When a power failure occurs in the electrical circuits to the following instruments, they will give a false indication as the indicator needle will remain in the same position as it was when the power was cut off.

a. Fuel quantity gage

b. Engine oil pressure gage

c. Fuel pressure gage

d. Transmission oil pressure gage

e. Servo hydraulic pressure gages

4–23. The directional indicator will give erroneous readings, and the needle will remain centered on the turn-and-bank indicator.

4–24. TAIL ROTOR FAILURE.

4–25. Tail rotor failure in a helicopter is the most difficult inflight emergency with which a pilot may be required to cope. The first indication of tail rotor failure is a loss in directional control. When tail rotor failure is experienced, main rotor torque will turn the helicopter to the right. The rate of turn will be governed by the amount of power being used at the time the failure occurred. The only means of reducing this turning tendency is to establish an autorotative glide. This is accomplished by reducing collective pitch and closing the throttle. In autorotation the helicopter will turn to the left, due to bearing and gear friction in the transmission system. The friction drag induced by the transmission system, however, is less than the torque induced by the engine and can be corrected by maintaining adequate gliding airspeed and by making appropriate corrections with the cyclic stick.

4–26. TAIL ROTOR FAILURE DURING TAKEOFF OR WHILE HOVERING BELOW 10 FEET.

4–27. In the event of tail rotor failure during takeoff or while hovering, main rotor torque will cause an immediate clockwise rotation of the fuselage. The following procedure should be followed to minimize further damage to the helicopter:

a. Throttle – CLOSED.

b. Cyclic stick – MAINTAIN LEVEL ATTITUDE.

c. Collective pitch lever – INCREASE. Increase to cushion landing.

d. Wheel brakes – DEPRESS. Depress wheel brakes upon touchdown.

4–28. TAIL ROTOR FAILURE DURING FLIGHT.

4–29. Tail rotor failure during flight will be indicated by a loss of directional control. The first and most important step is to regain directional control and accomplish a landing into the wind, if possible, using the following procedure:

a. Collective pitch lever – MINIMUM. Establish a glide of 60 knots minimum.

b. Shoulder harness inertia reel lock lever – LOCKED.

c. Cyclic stick – MAINTAIN DIRECTIONAL CONTROL. Maintain directional control by lateral movement of cyclic stick.

d. Cabin occupants – ALERTED.

Note

Turns may be accomplished by lateral movement of cyclic stick.

4–30. LANDING WITH TAIL ROTOR INOPERATIVE.

a. Tail wheel lock handle – LOCKED.

Note

Land into the wind if possible.

b. Cyclic stick – AFT. Flare to decrease forward speed and rate of descent.

c. Collective pitch lever–INCREASE. Increase to cushion landing and land in a tail wheel first attitude.

Note

Ground contact speed should be held to a minimum.

d. Collective pitch lever – MINIMUM (UPON GROUND CONTACT).

e. Cyclic stick – SLIGHTLY FORWARD.

f. Brake pedals – DEPRESS.

4–31. Except for possible sloppiness and sluggishness in the flight controls or a loss of pressure indicated on the primary servo hydraulic pressure gage, malfunctions of the primary servo system will not be evident to the pilot as the effects may be masked by the operation of the auxiliary servo system. It is important, therefore, that the primary servo system be checked before takeoff.

4–32. SERVO UNIT MALFUNCTION.

4–33. The three servo units of the primary servo system are located at the stationary star. All three servo units respond simultaneously and move in the same direction in response to movements of the collective pitch lever. Two of the servo units (lateral servo units) respond simultaneously but move in the opposite direction in response to lateral movements of the cyclic stick. One of the servo units (fore-and-aft servo unit) responds to fore-and-aft movements of the cyclic stick. Since all three movements can occur simultaneously through the action of the mixing unit, the position of any primary servo unit is the result of the combined input of the cyclic stick and the collective pitch lever. This results in a primary servo system in which any one servo has an effect on both collective pitch and cyclic (lateral or fore-and-aft) pitch.

4–34. The three servo units of the auxiliary servo system are located between the mixing units and the flight controls. Each control input acts independently on the corresponding auxiliary servo. The collective pitch lever positions the collective servo. The cyclic stick positions either or both the fore-and-aft servo or the lateral servo. This results in an auxiliary servo system in which only one servo has an effect on collective pitch, one on fore-and-aft cyclic pitch, and one on lateral cyclic pitch.

4–35. Because of the difference in location of the two servo systems, a malfunctioning primary servo unit will give different indications in the flight control system than a malfunctioning auxiliary servo unit. The indications of servo unit malfunction can be divided into two categories; coupled indications and uncoupled indications. Coupled indications are felt in both the collective pitch control and one channel (lateral or fore-and-aft) of the cyclic control stick. Coupled indications identify a malfunctioning primary servo unit as each primary servo unit effects both cyclic and

collective pitch. Uncoupled indications are felt either in the collective pitch control or one channel of the cyclic control stick. Uncoupled indications identify a malfunctioning auxiliary servo unit as each unit acts independently; one for collective pitch, one for lateral cyclic pitch, and one for fore-and-aft cyclic pitch. Should control difficulty occur in collective pitch plus one channel of cyclic pitch, place the flight control servo switch in the PRI. OFF position. Should control difficulty occur in collective pitch or one channel of cyclic pitch, place the flight control servo switch in the AUX. OFF position. For further discussion of servo unit malfunctions, refer to paragraph 2–26, Chapter 9.

4–36. FLIGHT CONTROL SERVO SYSTEM FAILURE.

4–37. LOSS OF PRESSURE.

4–38. Control of the helicopter can be maintained through either the primary or the auxiliary flight control system if one or the other should fail, though prolonged operation on one servo system is not recommended. Either system may be turned off by actuating the flight control servo switch, provided there is at least 1000 psi hydraulic pressure in the remaining system. When one servo system fails, the failed servo system should be shut off and airspeed reduced to 60 knots. Flight should be terminated as soon as it is practical to do so, due to the possibility of failure of the remaining servo system.

4–39. With the auxiliary servo system turned off or inoperative, the automatic stabilization equipment, the tail rotor servo, and the tail rotor pedal damper will be inoperative. Greater control forces will be encountered and care should be exercised in using the pedals to avoid abrupt changes of tail rotor pitch.

Note

In event of engine failure, automatic stabilization equipment and auxiliary servo system will become inoperative as auxiliary servo hydraulic pump is driven by engine.

4–40. For malfunctions and remedies of the flight control servo system, refer to table 4–I.

TABLE 4–I
MALFUNCTIONS AND REMEDIES OF FLIGHT CONTROL SERVO SYSTEM

Malfunction	Probable Cause	Remedy
Increase in friction in controls and marked change in tail rotor force	Loss of servo hydraulic pressure	Place flight control servo switch on AUX. OFF.
Creeping or heavy restraint in controls*	Maladjusted control linkage	If objectionable, place flight control servo switch on AUX. OFF.
Controls have tendency to overshoot	Excessive friction in followup linkage which centers servo unit pilot valve	If objectionable, place flight control servo switch on AUX. OFF.
Restricted movement of tail rotor pedals	Restriction in tail rotor pedal damper	Place flight control servo switch on AUX. OFF. **

*Symptoms might first appear only intermittently when automatic stabilization system is engaged.

**If restricted movement occurs when applying hard left tail rotor pedal, shut auxiliary servo off and release pressure on left tail rotor pedal momentarily to permit damper bypass to open and relieve pressure in damper.

4–41. AUTOMATIC STABILIZATION EQUIPMENT FAILURE. (MODEL CH-34C.)

4–42. In the event that automatic stabilization signals cause the helicopter to malfunction in the pitch, roll, yaw, or altitude channels, the system or part of the system may be rendered inoperative in the following manner:

a. One or more channels may be disengaged by placing the respective channel disengage switch, located on the motor box control panel, in the OFF position.

b. Pressing the AUTO STAB RELEASE button on the cyclic stick will disengage all four channels of the ASE system.

c. Pressing the button, marked STANDBY, on the ASE control panel will place the ASE system in standby.

d. Placing the flight control servo switch in the AUX. OFF position will render the system inoperative. The AUTO STAB RELEASE button, in addition to disengaging the stabilization equipment, will disconnect electrical power from the servo motors. Spring action will then return the servo motors to the null position and hold them in that position.

SECTION V
MISCELLANEOUS

5-1. LANDING EMERGENCIES (EXCEPT DITCHING).

5-2. Emergency landings in a helicopter should be performed in the same manner as normal landings. Hard or soft ground should make very little difference in landing as most helicopter landings are accomplished from a hover. If the terrain is soft or the surface is unprepared, rolling landings are not recommended, as the main wheels may sink into the ground and cause the helicopter to nose over. The following should be accomplished before emergency landings:

a. Crew – ALERTED BY USE OF INTERPHONE OR ALARM BELL.

b. Passengers – SEATED IN TROOP SEATS WITH SAFETY BELTS FASTENED.

c. Approach and landing – PROCEED WITH NORMAL APPROACH AND LANDING.

5-3. EMERGENCY EXITS AND ENTRANCES. (See figure 5-1.)

5-4. The pilots' compartment may be entered in an emergency through the sliding windows. The sliding windows are released by a release handle (1), marked EXIT RELEASE – TURN, located on the upper forward frame of each window and can be jettisioned from any position between open and closed. Emergency entrances to the cabin are through the cabin door and through the emergency hatches that contain the two windows on the left-hand side of the cabin. The door is released by pulling downward on the release handle (4), marked EXIT RELEASE – TURN, and then by pulling outward on door. The release handle is located in the upper forward corner of the door. The two emergency hatches that contain the windows on the left-hand side of the cabin are released by turning the release handles (8), marked EXIT RELEASE – TURN, in the direction of the arrows, and then pulling the emergency hatches outward. The release handles are located near the lower forward corner of each hatch. The rear window on the right side of the cabin may be released from its frame by pulling out on the tab (10), marked PULL TAB – EXIT RELEASE, which is located on the lower aft corner of the window frame. Broken yellow lines surrounding the window in the cabin door and the two windows on the left side of the cabin indicate where the fuselage may be cut should the escape hatches become jammed and fail to release.

5-5. DITCHING. (Refer to table 5-I.)

5-6. The helicopter is an ideal aircraft to ditch as it is capable of contacting the water with no forward movement; however, it has poor floating tendencies. By virtue of its versatility, most landings may be accomplished in a routine manner. Ditching may best be accomplished by either briefing the crew or by ditching drills, prior to all overwater flights.

5-7. PLANNED DITCHING. (See figure 5-2.)

5-8. In the event of anticipated fuel starvation at sea or for any unforseen reasons where ditching the helicopter is imminent but not immediate, much can be done to further protect personnel and sea survival gear prior to actual ditching of the helicopter by having a planned ditching procedure. Crews should be briefed on ditching procedures before takeoff on all overwater flights.

a. Cabin occupants – ALERT. Immediately alert cabin occupants over interphone when a ditching appears inevitable.

b. Sea survival gear – PREPARE. Pilot orders crew to prepare all sea survival gear for aerial drop. (Gear should be secured in daisy chain fashion.)

c. Distress message – TRANSMIT.

d. Pilots' sliding windows – OPEN.

e. Cabin door – OPEN.

f. Life vests – CHECK.

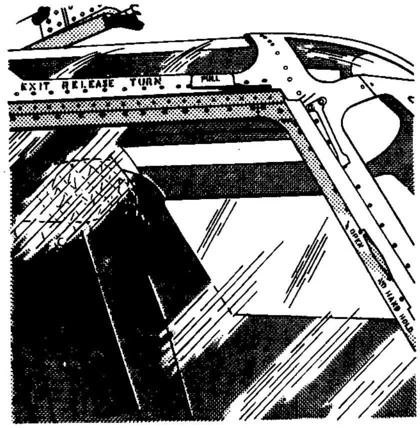
g. Sea marker – DISCHARGED. Discharge sea marker to aid in hovering while discharging personnel and equipment.

h. Helicopter – HOVER.

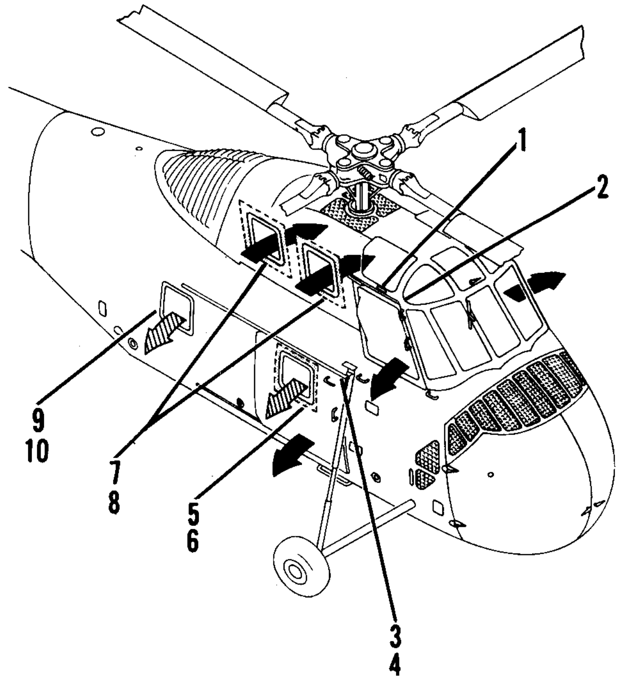
i. Sea survival gear – JETTISON.

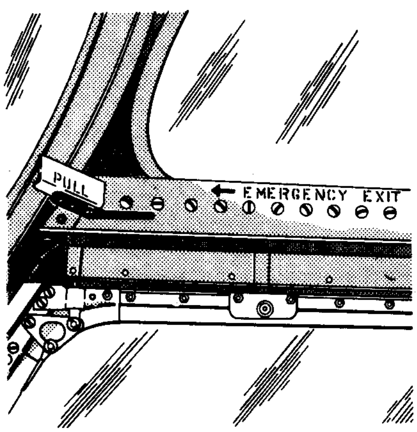
j. Cabin occupants and copilot – JUMP.

k. Helicopter – DRIFT DOWNWIND 50 YARDS.



1. OUTSIDE PILOTS' COMPARTMENT WINDOW RELEASE HANDLE





2. INSIDE PILOTS' COMPARTMENT WINDOW RELEASE HANDLE

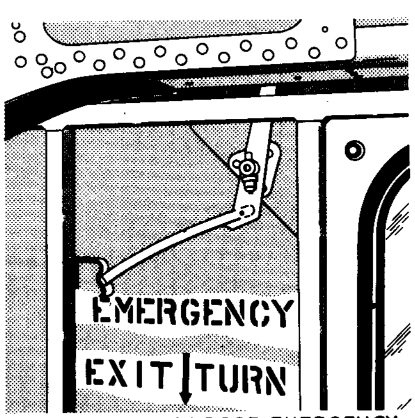
BAILOUT, DITCHING OR GROUND EXITS

GROUND EXIT ONLY

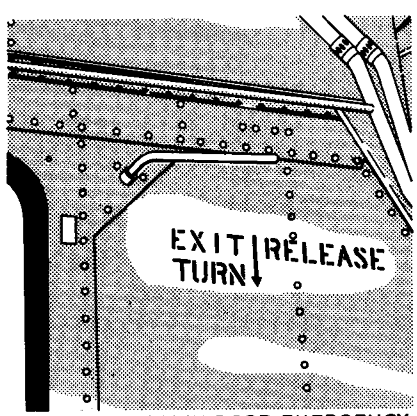
BREAK-IN AREA (CUT MARKS)

NOTE

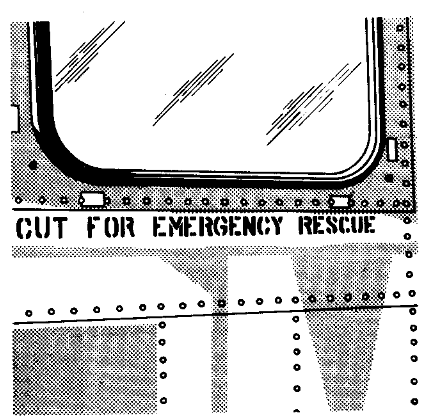
BEFORE AN EXIT CAN BE MADE THROUGH EXITS 8 AND 9, THE TROOP SEAT-BACKS SUPPORT BAR MUST BE PULLED FROM THE SPRING-LOADED CATCH TO ALLOW ENOUGH ROOM FOR EXIT.



3. INSIDE CABIN DOOR EMERGENCY RELEASE HANDLE

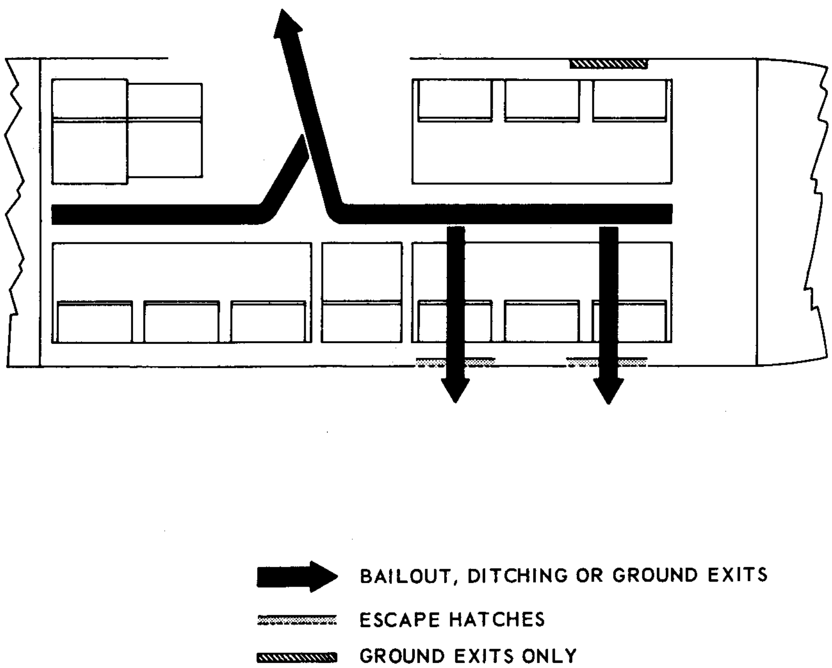


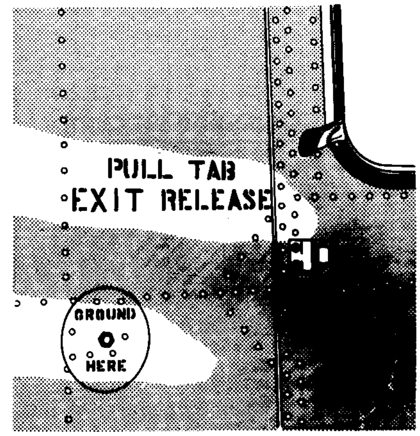
4. OUTSIDE CABIN DOOR EMERGENCY RELEASE HANDLE



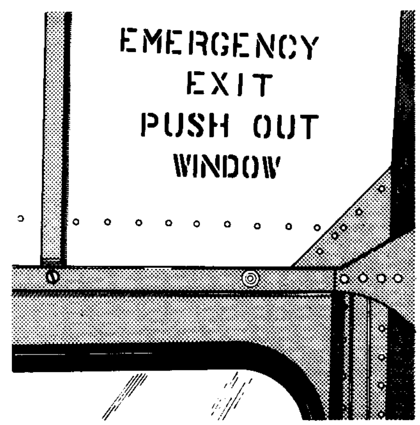
5. OUTSIDE CABIN DOOR (CUT MARKS)

Figure 5-1. Emergency Exits and Entrances (Sheet 1 of 2)

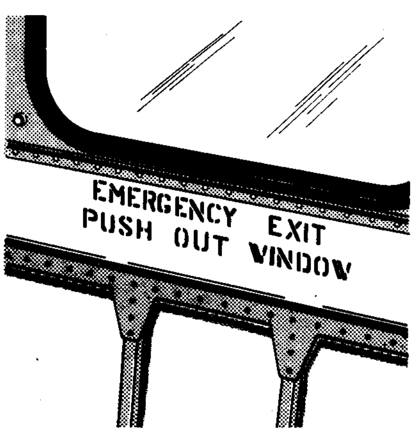




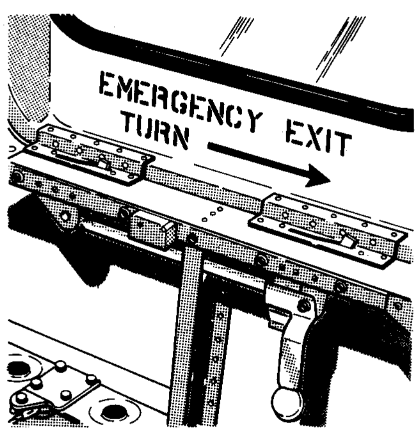
10. OUTSIDE CABIN EMERGENCY ESCAPE WINDOW



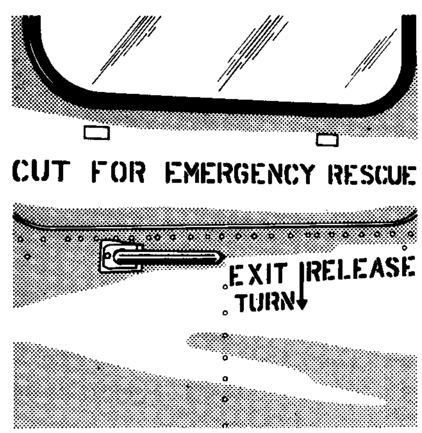
9. INSIDE CABIN EMERGENCY ESCAPE WINDOW



6. INSIDE CABIN DOOR EMERGENCY ESCAPE WINDOWS



7. INSIDE CABIN EMERGENCY ESCAPE HATCH RELEASE HANDLES



8. OUTSIDE CABIN EMERGENCY ESCAPE HATCH RELEASE HANDLES

Figure 5–1. Emergency Exits and Entrances (Sheet 2 of 2)

TABLE 5–I

DITCHING CHART

PLANNED DITCHING		IMMEDIATE DITCHING
PILOT	**PILOT'S SEAT**	**PILOT**
a. Alert crew.		*a.* Warn cabin occupants.
b. Order to prepare survival gear for aerial drop.		*b.* (1) Sliding window – OPEN. (2) Notify cabin occupants to jettison cabin door.
c. Transmit distress message.		*c.* Transmit distress message.
d. (1) Jettison sliding window. (2) Notify cabin occupants to jettison cabin door.		*d.* Shoulder harness inertia reel lock lever– LOCKED
e. Life vest – CHECK. (DO NOT INFLATE.)		*e.* Life vest – CHECK. (DO NOT INFLATE.)
f. Discharge marker.		*f.* Engine shut-down during autorotation.
g. Hover while crew drops survival gear and enters water.		*g.* Notify crew to brace for ditching.
h. Proceed 50 yards downwind and ditch helicopter.		*h.* During power-on landing water contact – ignition switch and fuel tank selector handle – OFF.
i. Leave helicopter through right sliding window exit.		*i.* Ditch, and abandon helicopter through right sliding window exit.
COPILOT OR OBSERVER	**COPILOT'S SEAT**	**COPILOT OR OBSERVER**
a. Sliding window – JETTISON.		*a.* Sliding window – OPEN.
b. With no cabin occupants on flight, enter cabin and drop survival gear immediately before exit.		*b.* Shoulder harness inertia reel lock lever – LOCKED.
c. Notify pilot, leave helicopter through left sliding window exit and drop into water.		*c.* Leave helicopter through left sliding window exit.
CREW CHIEF OR PASSENGERS	**TROOP SEATS**	**CREW CHIEF OR PASSENGERS**
a. Cabin door – JETTISON.		*a.* Cabin door – JETTISON.
b. Sea survival gear – PREPARE FOR AERIAL DROP.		*b.* (1) Cabin occupants in troop seats, safety belts fastened. (2) No troop seats, occupants on floor, backs against forward cabin bulkhead.
c. Lifevest – CHECK. (DO NOT INFLATE.)		*c.* Life vest – CHECK. (DO NOT INFLATE.)
d. On pilot's signaldrop sea survival gear and leave helicopter through cabin door exit.		*d.* On pilot's signal – BRACE FOR DITCHING.
		e. Leave helicopter through cabin door exit.

l. Collective pitch lever – DECREASE. Ditching should be accomplished from a hover heading into wind. Helicopter should be lowered vertically into water as slowlyas possible in alevel attitude.

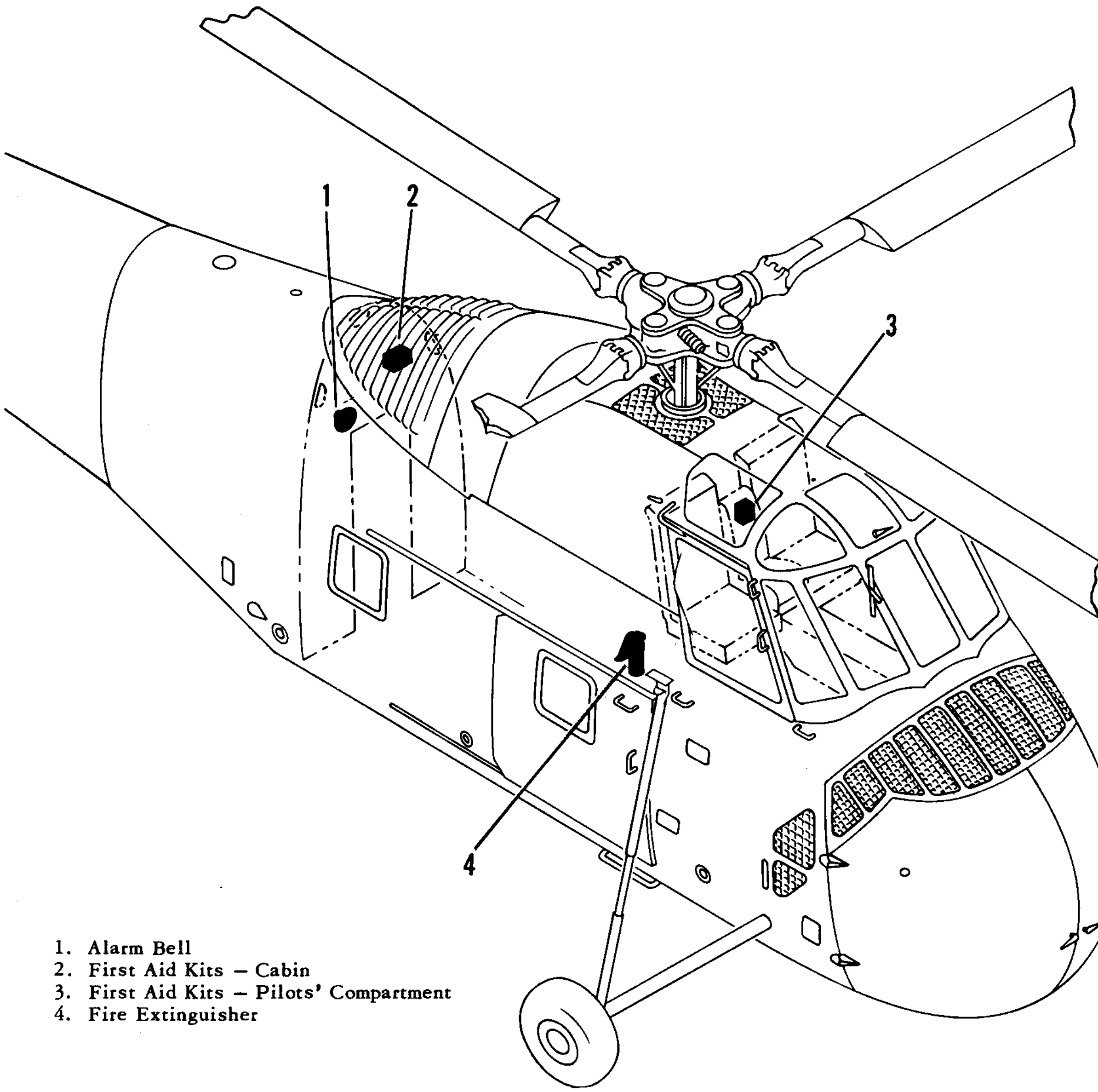
m. Ignition switch – OFF (UPON WATER CONTACT).

n. Rotor brake lever – ON.

o. Pilot – ABANDON HELICOPTER. When main rotor blades have stopped turning, abandon helicopter. Pilot can leave through either window in pilots' compartment.

5–9. IMMEDIATE DITCHING.

5–10. If ditching is caused by engine or tail rotor failure, proceed as instructed in paragraphs 2–1



1. Alarm Bell
2. First Aid Kits – Cabin
3. First Aid Kits – Pilots' Compartment
4. Fire Extinguisher

Figure 5–2. Emergency Equipment

and 4–25, with the exception that contact with water should, in every instance, be made with as little forward speed as possible. If ditching for other reasons, make a normal vertical landing.

5–11. In addition to these procedures, comply with the following during approach and flare.

5–12. IMMEDIATE DITCHING PROCEDURE.

a. Cabin occupants – ALERT. Alert cabin occupants over interphone and/or with the alarm bell.

Note

If helicopter is equipped with troop seats, notify cabin occupants to check that their safety belts are fastened, and to remain in troop seats with their arms braced against their knees until contact with water is made. If helicopter is not equipped with troop seats, cabin occupants should place any loose equipment that can be used as a cushion against the ladders on forward cabin bulkhead and sit on the floor with their backs braced against cushion and their heads between their knees.

Note

Forward seat in cabin provides optimum safety for a crash landing. Occupants sit facing aft with their backs against cabin forward bulkhead, which affords maximum protection for rapid deceleration from forward flight.

b. Pilots' sliding windows – OPEN.

c. Cabin door – OPEN.

d. Distress message – TRANSMIT.

e. Shoulder harness inertia reel lock lever – LOCKED.

f. Life vests – CHECK.

g. Cabin occupants – BRACE FOR DITCHING. Just before contact, notify cabin occupants over interphone and/or by alarm bell to brace for ditching.

h. Engine – SHUT DOWN (DURING AUTO-ROTATIVE DESCENT).

(1) Ignition switch – OFF.

(2) Fuel flow selector valve handle – OFF.

(3) Battery switch – OFF.

(4) Generator switch – OFF.

Note

During a power-on landing, as helicopter strikes water, turn ignition switch – OFF. Contact water in level attitude.

i. Rotor brake lever – ON.

j. Occupants – ABANDON. When the main rotor blades have stopped turning, abandon helicopter. Pilot and copilot leave through either sliding window in pilots' compartment and cabin occupants leave through cabin entrance.

WARNING

Do not inflate life raft until all personnel, including pilot, are together as raft will drift rapidly when inflated.

5-13. EMERGENCY JETTISON.

5-14. Cargo is the only internal item that can be jettisoned from the helicopter. If an emergency arises and the cargo has to be jettisoned, the crewmember or the copilot, who will have to climb down to the cabin from the pilots' compartment, will jettison the cargo through the cabin door. The cabin door may be jettisoned to allow rapid removal of cargo. If cargo is not jettisoned, it may shift or become loose upon landing. For jettison of external cargo, refer to paragraph 4-4, Chapter 6.

Note

When equipment is to be jettisoned, caution should be taken not to allow the equipment to rise up through the rotor blades and inflict damage.

5-15. BAILOUT. (See figure 5-1.)

5-16. It is advisable to appoint one crewmember to act as jumpmaster in the cabin of the helicopter on each flight. Appointing a jumpmaster will insure an orderly bailout and will tend to reduce panic. The appointed jumpmaster will occupy the front right cabin position and monitor the interphone throughout the flight. The crew is alerted over interphone with the command "PREPARE TO BAIL OUT" and/or with the alarm bell. The crew is directed to bail out over the interphone with the command "BAIL OUT" and/or with the alarm bell.

5-17. The optimum airspeed to abandon the helicopter is 50 to 60 knots.

5-18. If the bailout is caused by engine failure, tail rotor failure, or fire, the pilot should accomplish the appropriate procedure and alert the crew and passengers of the impending bailout by verbal means and with the alarm bell. When the prepare for bailout signal is sounded on the alarm bell or by the command "PREPARE TO BAIL OUT," the microphone switch will be placed in the ON position. (This will enable the jumpmaster to transmit without using the microphone switch.) When the bailout signal is sounded on the alarm bell or the command "BAIL OUT" is given, the jumpmaster will direct the orderly abandonment of the helicopter and will notify the pilot verbally by calling "CABIN CLEAR" and/or by tapping the pilot's leg to signify that he is abandoning the helicopter. Abandonment is accomplished by diving forward, keeping the feet and legs together, head down, and with the arms close to the body. A minimum 3-second delay must be taken, prior to pulling the rip cord after bailout, to avoid fouling the parachute on any part of the helicopter. The pilot and copilot will leave the helicopter through the sliding windows, and cabin occupants will leave through the cabin door.

5-19. BAILOUT PROCEDURE.

a. Cabin occupants – ALERTED. Alert cabin occupants over interphone with command "PREPARE TO BAIL OUT" and/or with alarm bell.

b. Pilots' sliding windows – OPEN.

c. Cabin door – OPEN. Acknowledge crew reporting that they are prepared to bail out.

d. Parachute – CHECK.

e. Bailout order – ISSUE. Give bailout order over interphone with the command "BAIL OUT" and/or with the alarm bell.

f. Cabin occupants – BAIL OUT. Dive out of cabin entrance head first.

g. Jumpmaster – REPORTS "CABIN CLEAR" AND BAILS OUT.

h. Pilot and copilot – BAIL OUT.

WARNING

Be sure shoulder straps are not entangled in parachute before abandoning helicopter.

CHAPTER 5
AVIONICS
SECTION I
SCOPE

1–1. GENERAL.

1–2. This chapter familiarizes the operating personnel with the electronic equipment used in the various CH-34 helicopters. Normal operation, emergency operation, description, and location are also contained within this chapter.

1–3. The systems which make up the electronic configuration will be treated as independent systems. The units within the systems are covered separately.

SECTION II
COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

2-1. TABLE OF COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT.

2-2. Table 2-1 consists of a complete list of the communication and associated electronic equipment that may be found in the various CH-34 helicopters. Also contained in this table are the common names, use, operator, range, location of controls, and remarks that are of interest to the using personnel.

2-3. ELECTRONIC AND ASSOCIATED EQUIPMENT.

2-4. POWER SUPPLY. Electrical power is supplied to the signal electronic equipment from the helicopter's 28-volt dc primary bus. The circuit from the primary bus to the signal electronic configuration passes through a radio master circuit breaker (figure 2-21, Chapter 2) and a radio master switch (figure 2-20, Chapter 2) and connects to a radio bus. Individual circuits, each containing a circuit breaker, connect the radio bus to each radio set of the signal electronic equipment.

2-5. RADIO MASTER CIRCUIT BREAKER. The radio master circuit breaker, marked RADIO MASTER is located on the overhead circuit breaker and fuse panel (figure 2-21, Chapter 2) and connects the primary bus with the radio bus.

2-6. RADIO MASTER SWITCH. The radio master switch, marked RADIO MASTER ON is located on the overhead switch panel. (See figure 2-20, Chapter 2.) The switch must be in the ON position to connect electrical power, supplied through the radio radio master circuit breaker, with the radio bus.

2-7. RADIO CIRCUIT BREAKER PANEL. The radio circuit breaker panel (figures 2-4 through 2-6), located on the right side of the radio control console, contains a circuit breaker for each radio set. The circuit breakers may be pulled out to completely disable any set, or they may be reset by pushing them in.

2-8. PILOT'S AND COPILOT'S MIKE SWITCH AND HEADSET-MIKE JUNCTION BOX. A two-position microphone switch, marked RADIO ICS, or INT, is located on each cyclic stick grip. (See figure 2-1.) Each switch connects its respective microphone to the interphone circuit when in the ICS or INT position, and to the radio transmitter

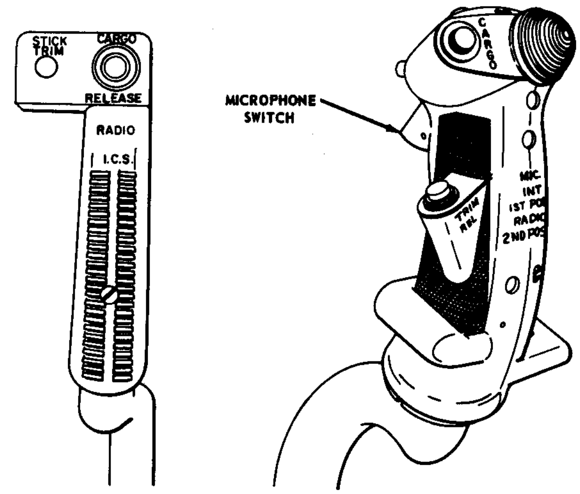


Figure 2-1. Microphone Switch, Cyclic Stick Grip

circuit when in the RADIO position. Junction boxes providing headset-mike connections as well as hooks for hanging the sets, are located at the top of the bulkhead at the rear of the pilots' compartment.

2-9. CABIN COMMUNICATION STATION. The cabin communication station (figure 2-2) is located on the upper forward bulkhead of the cabin. The station is provided with a headset-mike, a hook for supporting the headset-mike, and a bracket-mounted portable mike switch. The station includes a signal distribution panel identical to the pilot's and copilot's signal distribution panel, except that the transmitting switch is operative only for transmitting over the interphone. To transmit over the interphone, TRANS selector switch should be left in the INT position. The cabin communication station is equipped with a hot mike switch mounted alongside the signal distribution panel. The hot mike switch has both a momentary and a fixed position and is connected in parallel with the portable mike push-to-talk switch. When the hot mike switch is held in the momentary position, it functions the same as the portable mike switch. is placed in the ON position the microphone becomes a hot mike and is always operative, reliev-

TABLE 2-1
COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

COMMOM NAME (TYPE)	DESIGNATION	USE	OPERATOR	RANGE	LOCATION OF CONTROLS	REMARKS
Interphone	ARC Type 12	Intercommunication of crew	Crewmembers	Interior of helicopter	Radio control console and forward of cabin door	Interphone only for cabin communication station
Interphone	AN/ARC-44	Intercommunication of crew	Crewmembers	Interior of helicopter	Instrument panel, radio control console, overhead control panel, and cabin communication station	Crewmember for interphone only
FM Liaison	AN/ARC-44	Two-way voice communication	Pilots	Line of sight	Overhead control panel and radio control console	REM LOCAL switch should remain in the LOCAL position
VHF Command Set	ARC Type 12	Two-way voice communication	Pilots	Short range	Radio control console	
VHF Command Set	AN/ARC-73	Two-way voice communication	Pilots	Short range	Radio control console	680 preset transmitting channels 720 preset receiver channels
UHF Command Set	AN/ARC-55	Two-way voice communication	Pilots	Short range	Overhead control panel and radio control console	Has additional receiver present to monitor emergency frequency (243.0)
FM Homing Antenna	AN/ARA-31	Homing	Pilots			Operational when No. 1 switch on switch panel is in the home position.
LF Range Receiver	ARC Type 12	Low frequency homing and direction finding	Pilots	Long range	Radio control console	
Radio Receiving Set	AN/ARN-30A	Navigation and voice reception.	Pilots	Line of sight	Radio control console	Used in conjuction with glide slope
Radio Compass	AN/ARN-6	Navigation and direction finding	Pilots	Long range	Instrument panel	Also receives voice communications
Automatic Direction Finder	AN/ARN-59	Navigation and direction finding	Pilots	Long range	Instrument panel	Also receives voice communications
Marker Beacon	AN/ARN-32	Navigation	Pilots	Vertical to 50,000 feet	Instrument panel	Receives marker beacon information only
Glide Slope Receiver	MN-100A	Glide slope indication	Pilots	Proximity of glide slope transmitter	Radio control console	Receives glide slope information only
IFF	AN/APX-30	Identification friend or foe	Pilots			Provisions
IFF	AN/APX-44	Identification friend or foe	Pilots			Provisions
ASE	AN/ASN-23	Automatic stablization	Pilots		Radio control console	CH-34C only

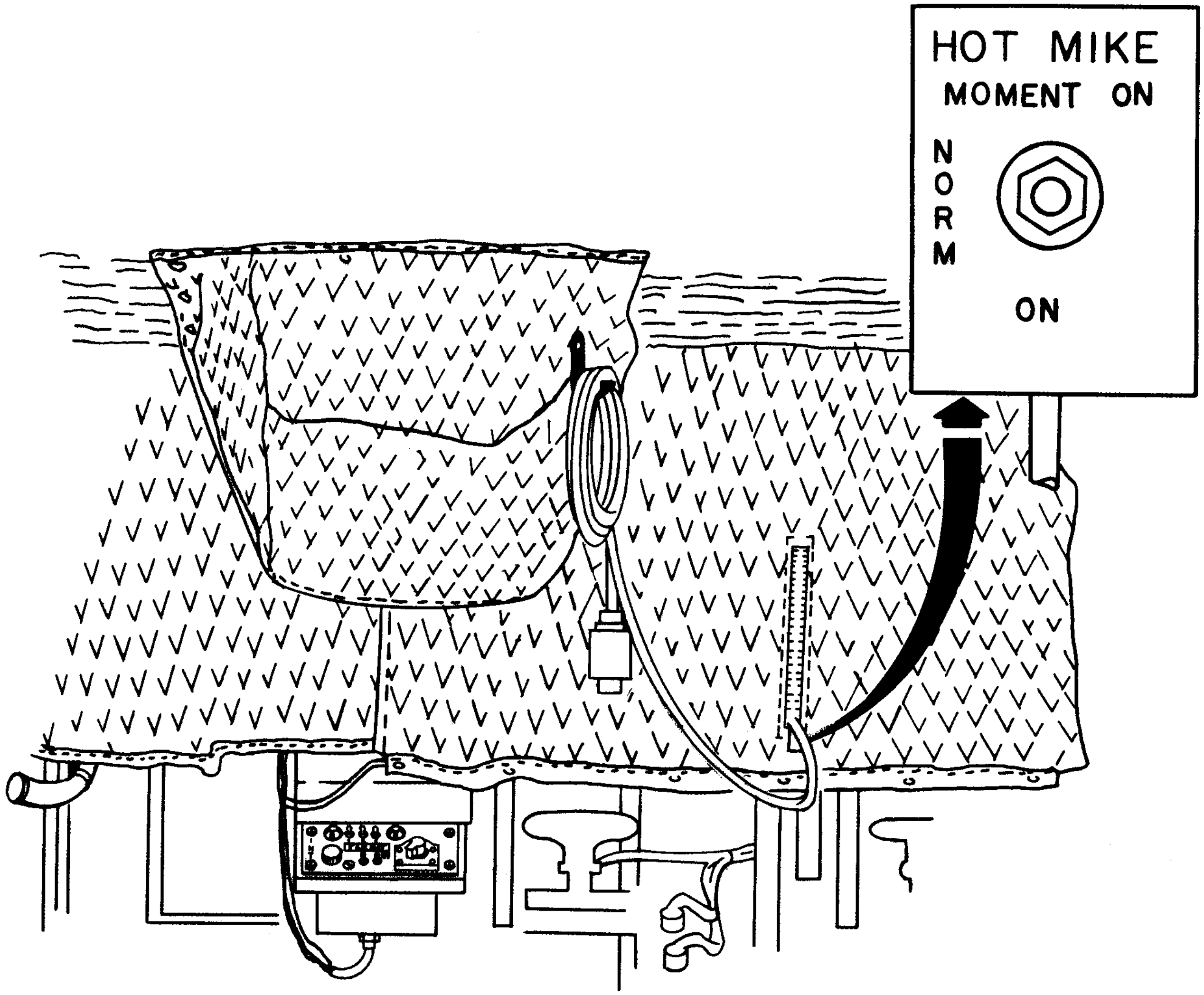


Figure 2–2. Cabin Communication Station

ing the operator of having to hold down the portable switch.

2–10. DESCRIPTION AND OPERATION OF COMMUNICATION EQUIPMENT.

2–11. COMMUNICATION EQUIPMENT. The communication equipment for the CH-34 helicopter is composed of the following: an FM Liaison Set AN/ARC-44, a VHF Command Set ARC Type 12 or AN/ARC-73, and a UHF Command Set AN/ARC-55. Interphone is provided by the ARC Type 12 or the AN/ARC-44.

2–12. SIGNAL DISTRIBUTION PANEL. The audio channels of all radio sets and the interphone system are tied together for simplified control and simultaneous operation at three identical signal distribution panels. (See figure 2–3.) The pilot's signal distribution panel (figures 2–4 and 2–5) is located on the radio control console. On Model CH-34 serial No. 57-1742 and subsequent, the pilot's signal distribution panel (figure 2–6) is located on the overhead radio control panel. The copilot's signal distribution panel is located on the left-hand side of the instrument panel (1, figure 2–10 and 44, figure 2–11, Chapter 2). The cabin signal distribution panel is located on the forward upper cabin wall. The signal distribution panels receive power from the dynamotor. The dynamotor is operational when the AN/ARC-44 circuit breaker is actuated, (switch panel (figures 2–4, 2–5, and 2–6) not installed) or when the AN/ARC-44 circuit breaker is actuated and the No. 3 switch on the switch panel is in the ICS position. The controls on each signal distribution panel consist of five receiver switches marked RECEIVERS, a volume control marked VOL, and a transmitter selector switch marked TRANS. The FM liaison set is connected to receiver switch No. 1 and the No. 1 position of the transmitter selector switch. The

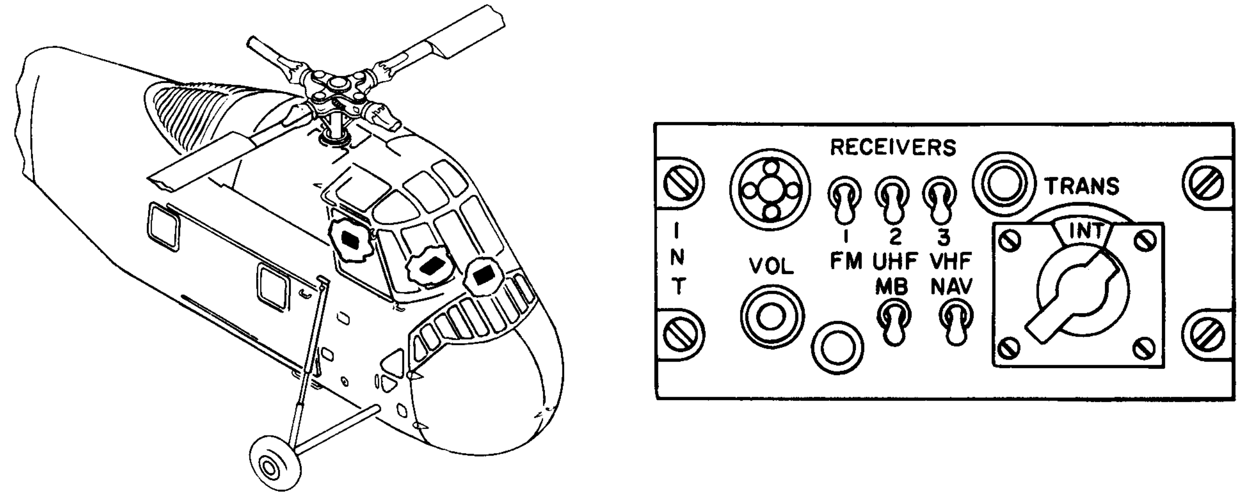


Figure 2–3. Signal Distribution Panel

No. 2 receiver switch and transmitter position are inoperative on helicoptors prior to serial No. 57-1684. On helicopters serial No. 57-1684 and subsequent, the UHF command set is connected to the No. 2 receiver switch and transmitter position. The VHF command set is connected to the No. 3 receiver switch and transmitter position. The LF radio compass or ADF set, and the Navigation Set ARN-30A are connected to the NAV receiver switch. The UHF marker beacon receiver is connected to the MB receiver switch. Interphone communication will break in automatically regardless of which, if any, radio sets are in use. The transmitter selector switch on the cabin signal distribution panel is inoperative and only interphone signals may originate from the cabin. The pilot and copilot may operate two different radio sets simultaneously without crosstalk by proper setting of the receiver switches and transmitter selector on their signal distribution panel. The volume control on the signal distribution panel may be set at a medium position and the volume controls of the individual sets adjusted to give equal volume in the headset. Subsequent adjustment of the control on the signal distribution panel will vary the volume of any set in operation uniformly.

2–13. AN/ARC-44 INTERPHONE OPERATION. To turn amplifier on:

a. RADIO MASTER switch – ON.

b. AN/ARC-44 circuit breaker – CHECK.

c. No. 3 switch (switch panel) – ICS POSITION.

d. Receiver switch (signal distribution panel) – SELECT RADIO RECEIVER TO BE HEARD. Interphone will break in.

e. VOL control – AS DESIRED.

To transmit over interphone:

f. TRANS selector switch (signal distribution panel) – INT POSITION.

g. Microphone switch (cyclic stick grip) – INT or ICS POSITION.

h. Portable microphone switch (cabin personnel) – DEPRESS.

To turn interphone off:

i. No. 3 switch (switch panel) – NO. 3 POSITION.

2–14. ARC TYPE-12 INTERPHONE. The interphone system operates through the amplifier of the VHF command set and is in operation automatically when the set is turned on. The interphone may be used whether the VHF command set is turned to an active or an inactive channel. To transmit over interphone from pilot's or copilot's position, the microphone switch on the cyclic stick grip is pressed to the ICS or INT position. Regular transmission will be interrupted when either mike switch is in the interphone position. At the crew interphone station, the crewmember's headset-mike is plugged into a portable box containing a mike switch. A hook is provided for stowing the box and the headset-mike when not in use. When the headset-mike is plugged in, interphone or radio signals can be heard. When the mike switch is depressed, the transmission will interrupt the interphone or radio communication but will not be transmitted over the radio.

2–15. ARC TYPE 12 INTERPHONE OPERATION. To turn set on:

a. RADIO MASTER switch – ON.

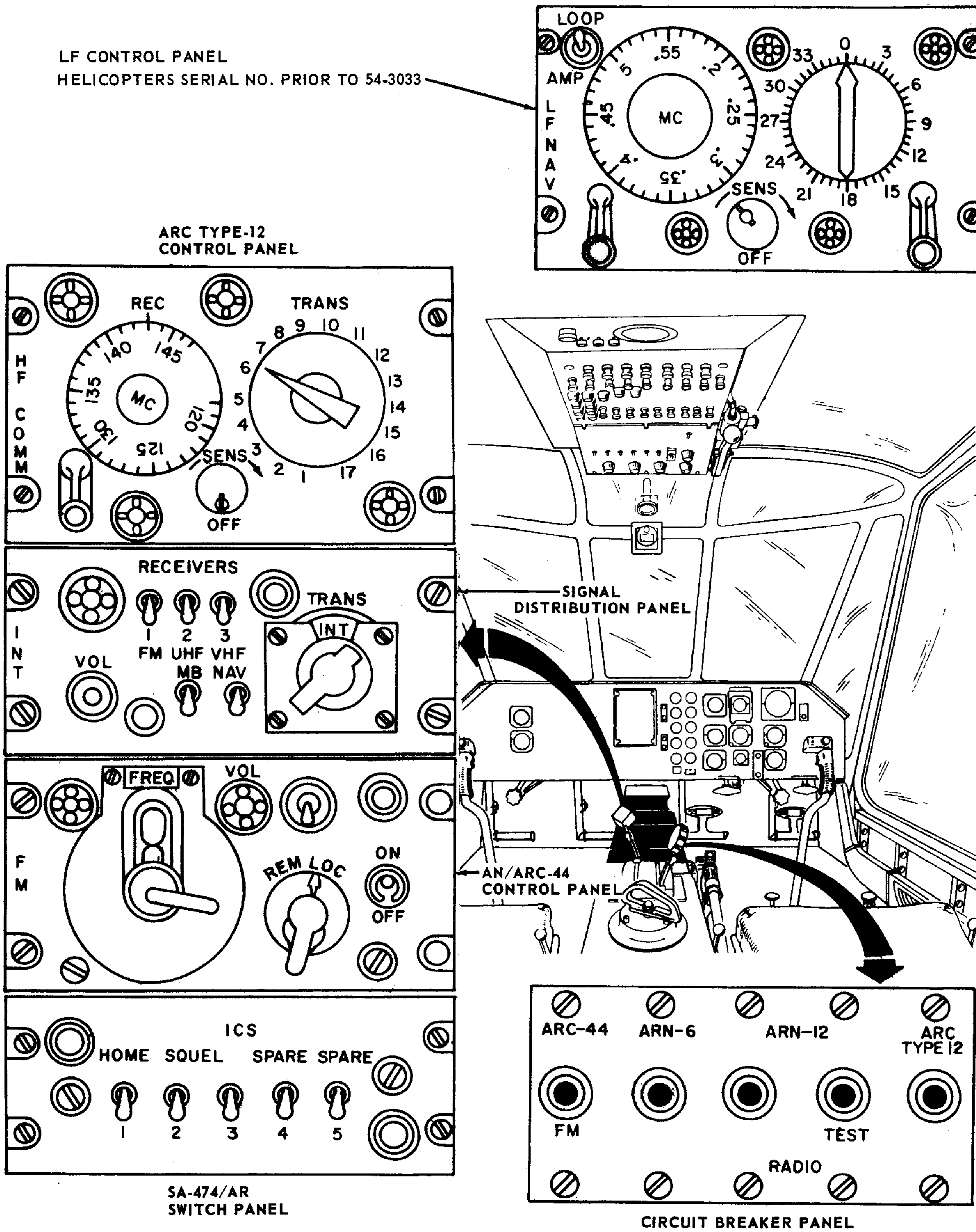


Figure 2–4. Radio Control Console and Circuit Breaker Panel (Helicopters Prior to Serial No. 57-1684)

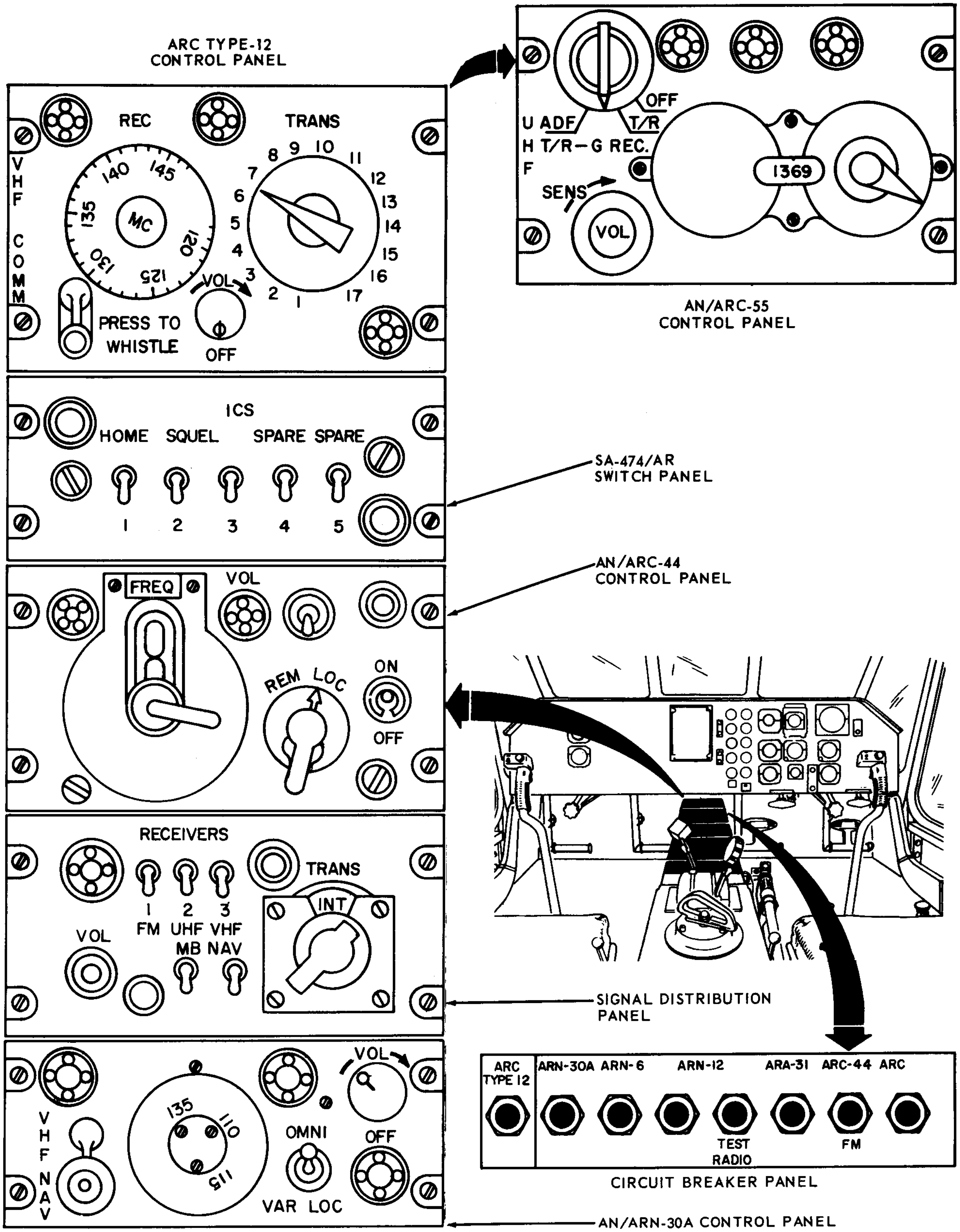


Figure 2–5. Radio Control Console and Circuit Breaker Panel (Helicopters Serial No. 57-1684 through 57-1741)

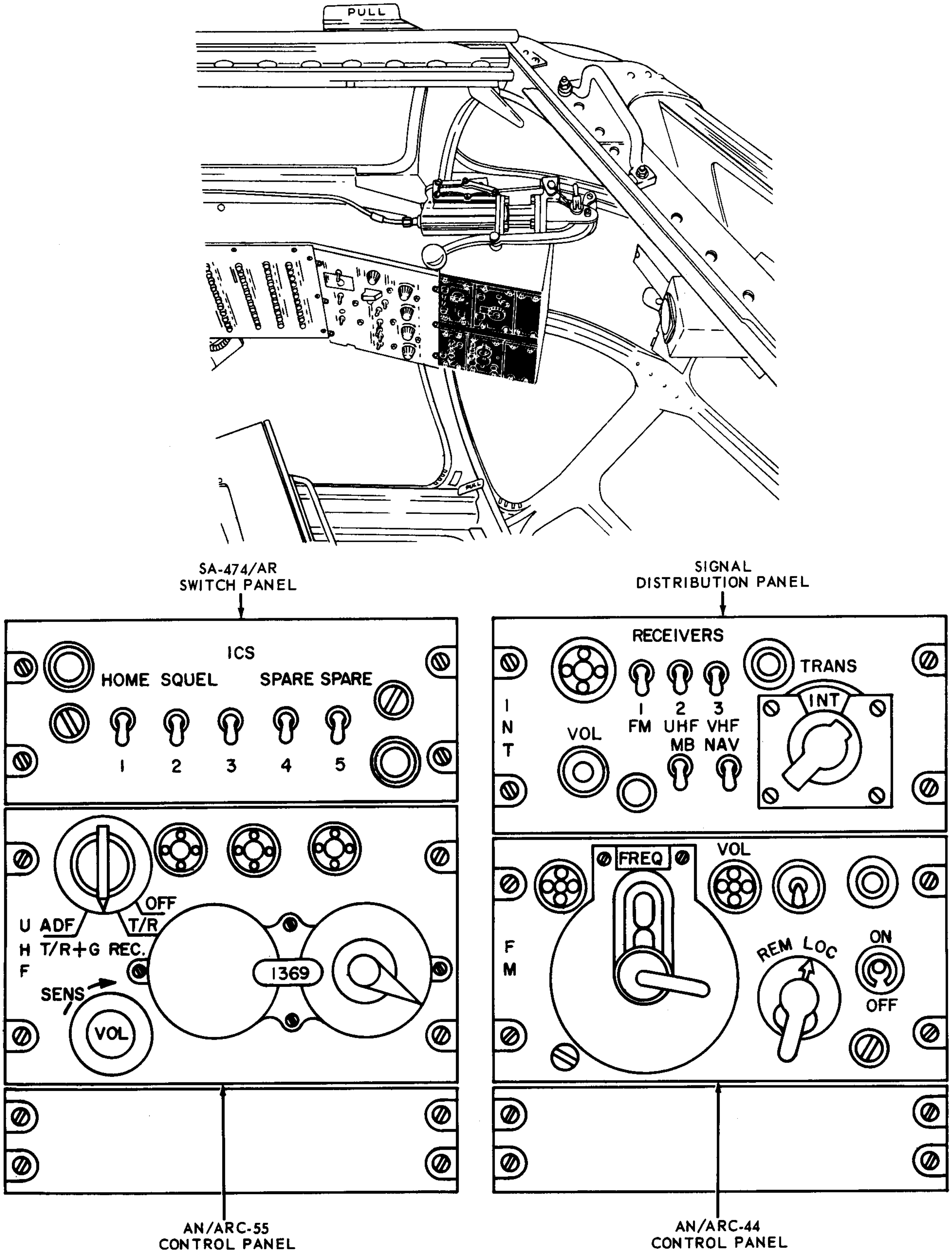


Figure 2–6. Overhead Radio Control Panel (Helicopters Serial No. 57-1742 and Subsequent)

b. ARC Type 12 circuit breaker – CHECK.

c. VOL-OFF control – ON. Rotate fully clockwise. Adjust volumn as desired.

To transmit:

d. Microphone switch (cyclic stick grip) – ICS POSITION. Speak into microphone.

To turn set off:

e. VOL-OFF control – OFF. Rotate fully counterclockwise.

2–16. SWITCH PANEL SA-474/AR. On helicopters prior to serial No. 57-1742, the switch panel (figures 2–4 and 2–5), is mounted on the radio control console. On helicopters serial No. 57-1742 and subsequent, the switch panel (figure 2–6) is mounted on the overhead control panel. The switch panel has five switches, three which are operative and two are spares. The No. 1 switch, when placed in the HOME position, energizes the Antenna Group AN/ARA-31. When the No. 1 switch is in the COMM position, it allows normal operation of the FM receiver-transmitter. Placing the No. 2 switch in the SQUEL position cuts down background and static noise, but permits medium and strong signals to be received. Placing the No. 2 switch in the No. 2 position renders the receiver more sensitive and weaker signals may be received with increased noise level. When the No. 3 switch is in the ICS position it permits the use of the interphone system. With the No. 3 switch in the No. 3 position, the interphone is inoperative. Switches No. 4 and 5 are not in use and are marked SPARE.

2–17. DESCRIPTION OF FM LIAISON SET AN/ARC-44. The FM Liaison Set AN/ARC-44 provides two-way communication, air-to-air, or air-to-ground. The frequency range of Liaison Set AN/ARC-44 permits communication with armored, artillery, or infantry units in the field. A second function of this radio set, when used in conjunction with the Antenna Group AN/ARA-31, is to provide facilities for homing on any signal within the frequency range of 24.0 to 49.0 megacycles. Interphone facilities are also provided by this radio set. Principal components as installed are a receiver-transmitter, three signal distribution panels, a control panel, a switch panel, and an antenna. The receiver is a double conversion, superheterodyne-type including homing circuits for the D-U signals which are coded in Antenna Group AN/ARA-31. The signal distribution panels, marked INT, tie the audio channels of all the radio sets and the interphone system together for simplified control and simultaneous operation of the various sets installed in the helicopter. Controls on the signal distribution panel permit the operator to monitor any of the receivers or to transmit (pilot and copilot only) over any of the transmitters installed. The control panel contains the power switch and the receiver volume control. The remote facilities are inoperative in this installation and the switch marked REM LOCAL should be kept in the LOCAL position. The switch panel, when installed, provides the means of switching from the FM liaison set communications to the antenna group. Other controls on the switch panel permit use of the interphone independent of the FM liaison set, and the means of disabling the squelch control of the receiver. On helicopters without the switch panel, a squelch disable switch accomplishes the same function. The AN/ARC-44 Antenna (3, figure 2–8). is a whip-type antenna located at the top of the pylon.

2–18. AN/ARC-44 CONTROL PANEL. AN/ARC-44 Control Panel (figures 2–4, 2–5, and 2–7), marked FM, is located on the radio control console or on the overhead control panel. The controls consist of a switch marked ON-OFF, a tuning control with a frequency indicating window marked FREQ, a volume control marked VOL, and a two-position switch marked REM LOCAL. The REM LOCAL switch is inoperative and should be kept in the LOCAL position. The FM liaison set is connected to the signal distribution panel at receiver switch marked No. 1 or FM and the transmitter selector switch position No. 1. The ON-OFF switch turns the FM liaison set on or off as desired. Frequency selection is accomplished by the tuning control and is indicated in the FREQ window. The volume control, marked VOL, is used for adjusting the audio level of the FM liaison set. The squelch circuit is controlled from the switch panel (figures 2–4, 2–5, and 2–7), located on the radio control console, or from the switch marked SQUELCH DISABLE AN/ARC-44 located on the instrument panel.

2–19. FM LIAISON SET AN/ARC-44 OPERATION. To turn set on and receive:

a. RADIO MASTER switch – ON.

b. AN/ARC-44 circuit breaker – CHECK.

c. No. 3 switch (switch panel) – ICS POSITION.

d. ON-OFF switch (control panel) – ON.

e. Receiver switch No. 1 (signal distribution panel) – ON.

f. HOME-COMM switch (switch panel) – COMM.

g. VOL control – AS DESIRED.

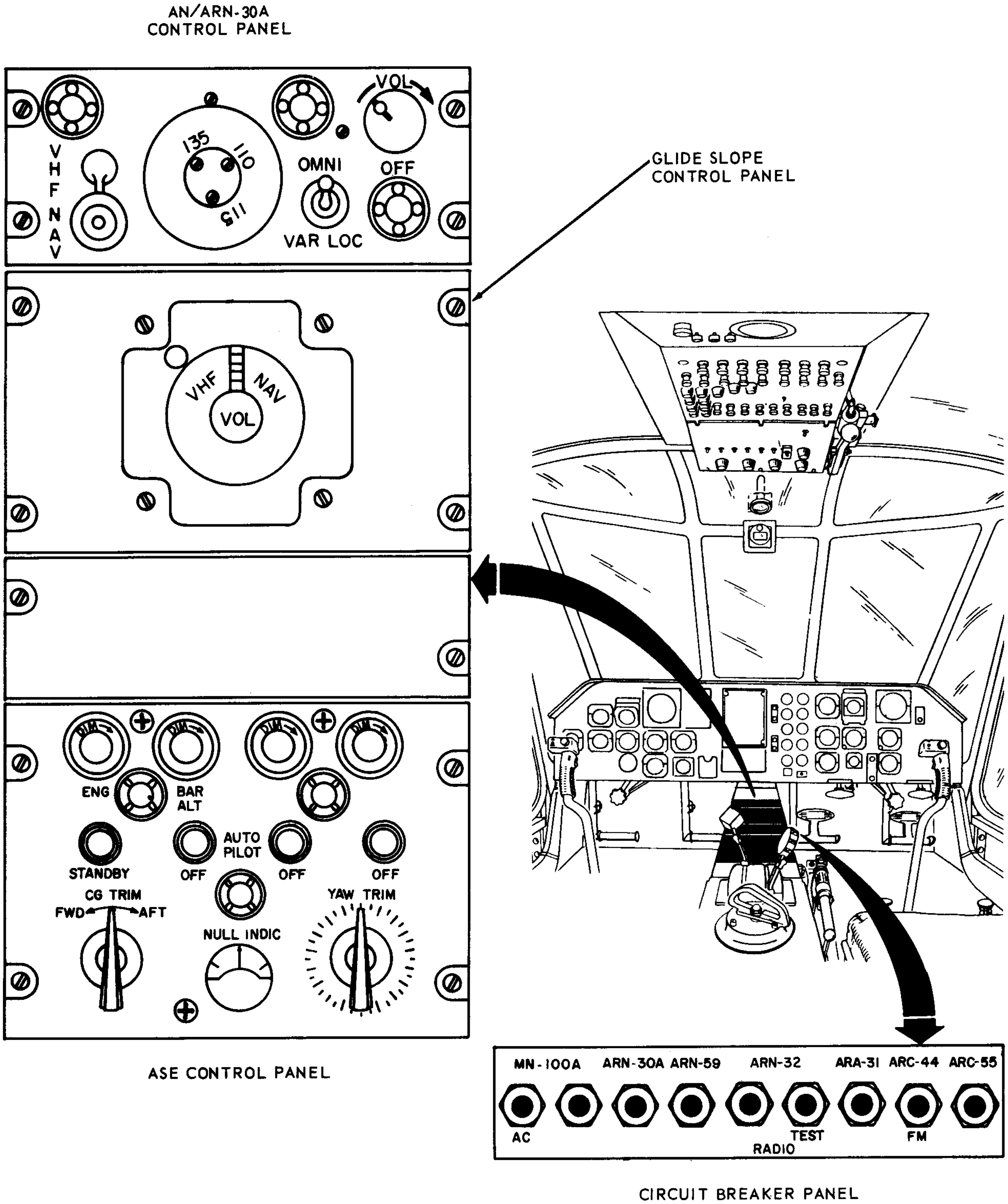
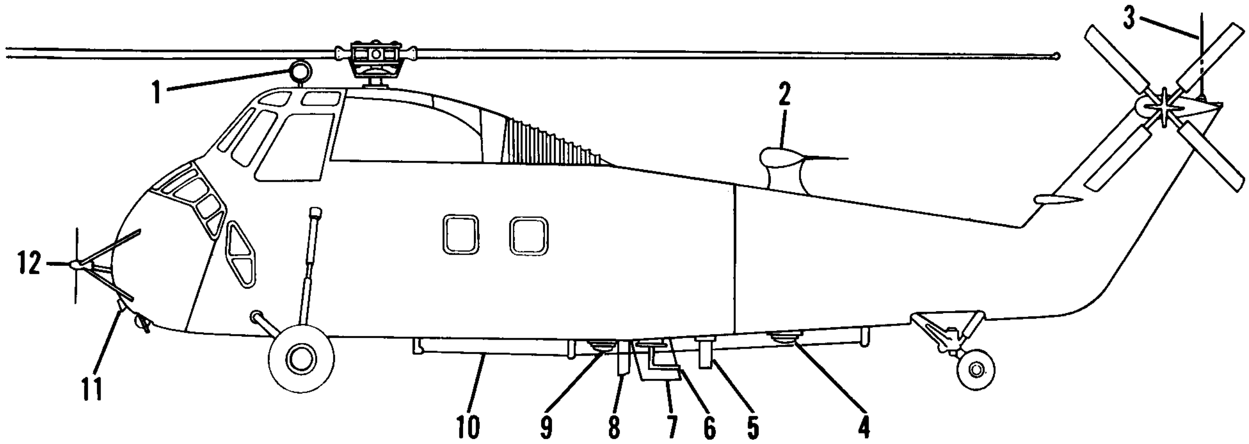


Figure 2–7. Control Console and Circuit Breaker Panel (Helicopters Serial No. 57-1742 and Subsequent.)



1. LF Range Receiver Loop Antenna (Helicopters Serial No. Prior to 54-3033).
2. AN/ARN-30A Antenna (Helicopters Serial No. 57-1684 and Subsequent).
3. AN/ARC-44 Antenna (Helicopters Serial No. 54-882 and Subsequent).
4. AN/ARN-12 Antenna (Helicopters Serial No. 54-882 through 57-1725, and Helicopters Serial No. Prior to 57-1742 as Modified to CH-34C). AN/ARN-32 Antenna (Helicopters Serial No. 57-1725 and Subsequent).
5. AN/ARC-55 Antenna (Helicopters Serial No. 56-4315, 56-4316, 56-4320, 57-1684 through 57-1725, and 57-1741 and Subsequent).
6. ARC TYPE-12 Antenna (Helicopters Serial No. Prior to 57-1725 and Helicopters Serial No. Prior to 57-1742 as Modified to CH-34C).
7. AN/ARC-73 Antenna (Helicopters Serial No. Prior to 57-1742 as Modified to CH-34C).
8. AN/APX-44 IFF Antenna (Provisions), (Helicopters Serial No. Prior to 57-1742 as Modified to CH-34C).
9. AN/ARN-6 Loop Antenna (Helicopters Serial No. 54-3034 through 57-1725 and Helicopters Serial No. Prior to 57-1742 as Modified to CH-34C).
   AN/ARN-59 Loop Antenna (Helicopters Serial No. 57-1726 and Subsequent).
10. AN/ARN-6 Sense Antenna (Helicopters Serial No. 54-3034 through 57-1725 and Helicopters Serial No. Prior to 57-1742 as Modified to CH-34C).
    AN/ARN-59 Sense Antenna (Helicopters Serial No. 57-1725 and Subsequent).
    LF Range Receiver Sense Antenue (Helicopters Serial No. Prior to 54-3033).
11. Glide Slope Antenna (Helicopters Serial No. 57-1742 and Subsequent).
12. AN/ARA-31 Antenna Group (Helicopters Serial No. 57-1684 and Subsequent).

Figure 2–8. Antenna Location (Typical)

To transmit:

h. Frequency selector control (control panel) – AS DESIRED.

To transmit:

i. TRANS selector switch (signal distribution panel) – NO. 1 POSITION.

j. Microphone switch (cyclic stick grip) – RADIO POSITION. Speak into microphone.

To turn set off:

k. ON-OFF switch (control panel) – OFF.

2–20. DESCRIPTION OF VHF COMMAND SET ARC TYPE 12. The VHF Command Set ARC Type 12 is a VHF receiver-transmitter which operates in the frequency range of 118.0 to 148.0 megacycles. Its function is to provide short range, two-way voice, air-to-ground communications. Principal components of the set as installed are Transmitters T-363/ARC and T-366/ARC, a receiver, a control panel, and an antenna. The transmitters are four-tube, five-channel, crystal-controlled, voice-amplitude modulated transmitters. Transmitter T-363/ARC operates in the frequency range of 132.0 to 148.0 megacycles and Transmitter T-366/ARC operates in the frequency range of 116.0 to 132.0 megacycles. The receiver is a nine-tube superheterodyne continuously tunable over the frequency range of 118.0 to 148.0 megacycles. The control panel (figures 2–4 and 2–5), marked VHF COMM, contains the combination power switch for transmitter cyrstal frequency, and a tuning crank for tuning the receiver to the desired frequency as indicated on the associated

dial. The antenna (6, figure 2–8) is an L type antenna, located on the bottom of the fuselage.

2–21. ARC TYPE 12 CONTROL PANEL. VHF Command Set ARC Type 12 is remotely controlled from the control panel (figures 2–4 and 2–5), marked VHF COMM, located on the radio control console. The controls consist of a 17-position transmitter switch with a frequency dial calibrated in megacycles, and a volume knob with an off position at full counterclockwise rotation. The tuning crank, marked PRESS TO WHISTLE, is depressed to permit fine tuning of the receiver. VHF Command Set ARC Type 12 is connected to the signal distribution panel at receive switch No. 3 or VHF, and the No. 3 position of the transmitter selector switch. The transmitters will operate only on those channels for which crystals are installed, as shown on the radio frequency card mounted on the standby compass bracket.

Note

No transmission shall be made on emergency (distress) frequency channels except for emergency purposes.

2–22. VHF COMMAND SET ARC TYPE 12 OPERATION (SERIAL NO. PRIOR TO 54-882). To turn set on and receive:

a. RADIO MASTER switch – ON.

b. ARC Type 12 circuit breaker – CHECK.

c. VOL-OFF control – ON. Rotate fully clockwise and allow for warmup.

d. Tuning crank – ROTATE TO DESIRED FREQUENCY.

e. VOL-OFF control – AS DESIRED.

To transmit:

f. TRANS selector switch – ROTATE TO DESIRED FREQUENCY.

g. PRESS TO WHISTLE control – DEPRESS AND ADJUST FOR MAXIMUM WHISTLE.

h. Microphone switch (cyclic stick grip) – RADIO POSITION. Speak into microphone.

To turn set off:

i. VOL-OFF control – OFF. Rotate fully counterclockwise.

2–23. VHF COMMAND SET ARC TYPE 12 OPERATION (SERIAL NO. 54-882 AND SUBSEQUENT). To turn set on and receive:

a. RADIO MASTER switch – ON.

b. ARC Type 12 circuit breaker – CHECK.

c. No. 3 switch (switch panel) – ICS POSITION.

d. VOL-OFF control – ON. Rotate fully clockwise and allow for warmup.

e. Receiver switch No. 3 or VHF (signal distribution panel) – ON.

f. Tuning crank (VHF control panel) – ROTATE TO DESIRED FREQUENCY.

To transmit:

g. TRANS selector switch (signal distribution panel) – NO. 3 POSITION.

h. TRANS channel selector switch (VHF control panel) – ROTATE TO DESIRED CHANNEL.

i. PRESS TO WHISTLE control – DEPRESS AND ADJUST FOR MAXIMUM WHISTLE.

j. Microphone switch (cyclic stick grip) – RADIO POSITION. Speak into microphone.

To turn set off:

k. VOL-OFF control – OFF. Rotate fully counterclockwise.

2–24. DESCRIPTION OF VHF COMMAND SET AN/ARC-73. VHF Command Set AN/ARC-73 is a VHF receiver-transmitter that operates on crystal-controlled channels in the 116.00 to 151.95 megacycle frequency range. Its primary function is to provide two-way, air-to-air, or air-to-ground, voice communication. Principal components of the system as installed are a receiver, a transmitter, two control panels, and an antenna. The receiver is a double-conversion superheterodyne type employing nine tubes and one transistor. The receiver operates on any one of 720 preset channels in the frequency range of 116.0 to 151.95 megacycles. The transmitter provides 25 watts output on the 680 available channels in the 116.0 to 149.95 megacycle range. The control panel (figure 2–9), marked VHF RCVR COMM, controls the power and volume for the VHF command set. This control panel also controls the operating frequency for the receiver. The control panel (figure 2–9), marked VHF XMTR COMM, controls the operating frequency of the transmitter. The VHF command set antenna (7, figure 2–8) is airfoil shaped and protrudes from the bottom of the aft fuselage.

2–25. AN/ARC-73 CONTROL PANELS. The two AN/ARC-73 Control Panels (figure 2–9) are located on the radio control console. The VHF RCVR COMM control panel controls the power and volume for the AN/ARC-73 system by placing the POWER-ON-OFF switch in the ON position. This panel also controls the operating frequency of the receiver. The VOL control on the receiver control panel is used to adjust the volume of the receiver.

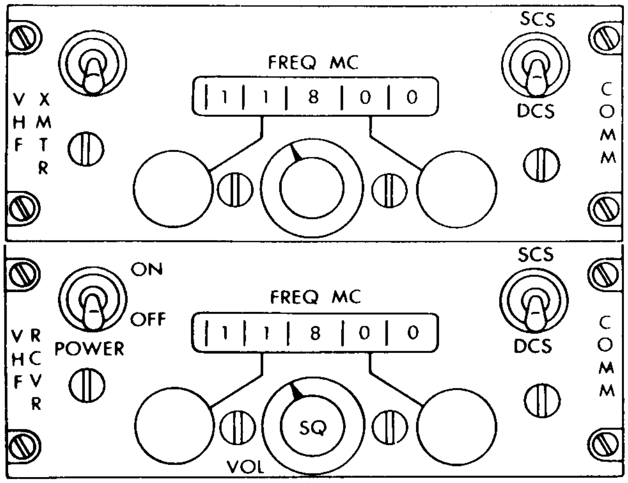


Figure 2-9. AN/ARC-73 Control Panels

The SQ control is a squelch control which is adjusted to minimize annoying background noise. The VHF transmitter control panel, marked VHF XMTR COMM, controls the operating frequency of the AN/ARC-73 transmitter. Both control panels are inoperative when the POWER-ON-OFF switch on the receiver control panel is in the OFF position.

2-26. VHF COMMAND SET AN/ARC-73 OPERATION. To turn set on and receive:

a. RADIO MASTER switch – ON.

b. AN/ARC-73 circuit breaker – CHECK.

c. No. 3 switch (switch panel) – ICS POSITION.

d. Receiver switch No. 3 or VHF (signal distribution panel) – ON.

e. TRANS selector switch (signal distribution panel) – NO. 3 POSITION.

f. POWER-ON-OFF switch (VHF receiver control panel) ON.

g. Frequency selector controls (VHF receiver control panel) – AS DESIRED.

h. VOL control (VHF receiver control panel) – AS DESIRED.

To transmit:

i. Frequency selector controls (VHF transmitter control panel) – AS DESIRED.

j. Microphone switch (cyclic stick grip) – RADIO POSITION.

To turn set off:

k. POWER-ON-OFF switch – OFF.

2-27. DESCRIPTION OF UHF COMMAND SET AN/ARC-55. UHF Command Set AN/ARC-55 is a UHF receiver-transmitter which operates in the frequency range of 225.0 to 399.9 megacycles. Its function is to provide two-way amplitude-modulated voice communication air-to-air or air-to-ground. Principal components of the set as installed are a receiver-transmitter, a control panel, and an antenna. The receiver-transmitter permits two-way communication on any one of 1750 frequencies. A guard receiver, separate from the main receiver, makes possible the constant monitoring of a guard frequency fix tuned to 243.0 megacycles. The remote control panel, located on the radio control console, operates the UHF set. Three frequency selectors provide for manual selection of a desired frequency for reception or transmission within the frequency range of 225.0 to 399.9 megacycles. The UHF command set antenna (5, figure 2-8) is is mounted beneath the fuselage.

2-28. AN/ARC-55 CONTROL PANEL. The AN/ARC-55 Control Panel (figures 2-5 and 2-7), marked UHF, is located on the radio control console or the overhead radio control panel. Operational controls consist of a four-position function switch, a sensitivity control, a volume control, and three frequency selectors. The function switch controls operation of the set in the following manner: In the OFF position, all power is removed from the equipment. In the transmit and receive, T/R position, the transmitter is on in standby, the main receiver is on, and the ADF set is in standby. In the transmit and receive plus guard receive, T/R + G REC position, the transmitter is on in standby, both main and guard receivers are on, and the ADF set is in standby. In the automatic direction finder, ADF position, the transmitter and guard receiver are in standby, and both the ADF set and the main receivers are on. Reception on the guard frequency is provided through the separate guard receiver if the function switch is in the T/R + G REC position, regardless of the setting of the frequency selectors. To transmit on the guard frequency channel, turn the function switch to the T/R position, turn the frequency selector to the assigned guard frequency, and key the transmitter. This actually turns the separate guard receiver off, but tunes the main transmitter and receiver to the guard frequency. The volume control, marked VOL, should be so adjusted that receiver signal strength is at an understandable and comfortable level, with the radio volume control on the signal distribution panel set to about one-half maximum volume. Receiver volume may then be controlled by the radio volume control on the signal distribution panel to suit the individual requirements of the

pilot and copilot. The sensitivity control, marked SENS, should be set to give the best signal-to-noise ratio. If the sensitivity control is set too high, a hiss will be heard in the headsets and incoming signals may not be heard. Three frequency selectors provide for manual selection of a desired frequency for reception or transmission within the frequency range. The transmitter may be tone-modulated at 1020 cycles for emergency or direction finder purposes. However, the TONE-VOICE toggle switch that controls this function is located on the local control panel in the electrical and electronics compartment and is, therefore, not readily accessible in flight.

Note

No transmission shall be made on emergency (distress) frequency channels, except for emergency purposes.

2–29. UHF COMMAND SET AN/ARC-55 OPERATION. To turn set on and receive:

a. RADIO MASTER SWITCH – ON.

b. AN/ARC-55 circuit breaker – CHECK.

c. No. 3 switch (switch panel) – ICS POSITION.

d. UHF function switch (UHF control panel) – AS DESIRED.

CAUTION

Allow at least 1 minute for set to warm up before operating to preclude damage to equipment.

e. UHF or No. 2 receiver switch (signal distribution panel) – ON.

f. Frequency selector (UHF control panel) – AS DESIRED.

g. VOL control (UHF control panel) – AS DESIRED.

h. SENS control – ADJUST FOR BEST SIGNAL-TO-NOISE RATIO.

To transmit:

i. TRANS selector switch (signal distribution panel) – NO. 2 POSITION.

j. Microphone switch (cyclic stick grip) – RADIO POSITION. Speak into microphone.

To turn set off:

k. UHF function switch – OFF.

2–30. DESCRIPTION AND OPERATION OF THE AUTOMATIC STABILIZATION EQUIPMENT (ASE) (MODEL CH-34C).

2–31. AUTOMATIC STABILIZATION EQUIPMENT (ASE) (MODEL CH-34C). Only Model CH-34C helicopters are equipped with automatic stabilization equipment. The automatic stabilization equipment (ASE) is designed to improve the handling characteristics of the helicopter to permit automatic cruising flight and hands-off flight by introducing absolute static and dynamic stability. The automatic stabilization equipment used in this helicopter differs from the auto-pilot used in a fixed-wing aircraft in that it may be engaged at all times, with the stability corrections being introduced into the flight control system in such a manner that the pilot has complete control of the helicopter through normal use of the flight controls. The pitch and roll of the fuselage is stabilized. by differential input signals, and the unrestricted relationships of the cyclic stick to the average main rotor tip-path plane is maintained without necessitating on override force on the part of the pilot.

2–32. The automatic stabilization equipment has two modes of operations: attitude and directional retention and barometric altitude retention. In the attitude mode of operation, pitch and roll angles of the fuselage are held constant by means of signals received from a vertical gyro reference, and fuselage heading is held constant by signals received from the directional gyro compass system. Changes in pitch and roll angles and changes in heading made by the pilot will be held by the automatic stabilization equipment. Small pitch and roll stabilization corrections are constantly added, even though the pilot moves or holds the cyclic stick, but directional stabilization occurs only when the pilot's feet are removed from the tail rotor pedals. A microswitch, on each tail rotor pedal, disengages the directional stabilization channel when the pilot's feet are on the pedals. In the constant altitude mode of operation, altitude is stabilized by signals received from a barometric controller. Changes in altitude are accomplished by disengaging the altitude mode of ASE, actuating the flight controls normally to change altitude, and reengaging the altitude mode after stabilizing the altitude, attitude, and airspeed of the helicopter. Since the control of the fuselage pitching attitude determines airspeed, both modes combine to provide automatic cruising flight with a constant airspeed and heading at a constant attitude. Automatic stabilization will function with or without the stick trim system being engaged; however, the stick trim system should be used in

conjunction with the automatic stabilization system and the stabilization system should be allowed to correct for gusts, etc, during flight. If the stick trim system is not used or if the pilot attempts to correct for gusts, etc, by movements of the flight controls while the automatic stabilization equipment is engaged, overcontrol and roughness may be encountered.

2–33. Electrical power for the operation of the automatic stabilization equipment is supplied by the main inverter and the primary bus. The auxiliary servo system provides the means of actuating the flight control system on signals received from the automatic stabilization equipment.

WARNING

During a loss of 115-volt, 400-cycle power which may be caused by switching of inverters, J-2 compass gyro will switch from slow-slave to rapid-slave for 2 or 3 minutes after 115-volt, 400-cycle power is returned. During this period of rapid-slave, yaw channel of ASE receives erroneous signals which have a tendency to make helicopter oscillate in its heading. Helicopter can be flown during this 2 to 3-minute period, with ASE on, by placing feet on tail rotor pedals, thus disengaging yaw channel of ASE.

2–34. AUTOMATIC STABILIZATION EQUIPMENT CONTROL PANEL. The automatic controls are located on an automatic stabilization equipment control panel (figures 2–7 and 2–10) mounted on the radio console. The control consists of two engage buttons extending across the top left of the panel with disengage buttons directly below them, a center-of-gravity trim knob, a null indicator, and a yaw trim knob. There are two nonfunctional buttons on the top right of the panel and two more nonfunctional buttons below them. The engage and disengage buttons operate in pairs to control the two modes of operation of the automatic stabilization equipment. The two buttons, marked ENG and STANDBY, control mode 1 and the two buttons, marked BAR ALT and OFF, control mode 2. When the engage buttons are pushed in, a green light in the center of the button will come on, signifying that the mode of operation controlled by that button is in operation. To engage the system, press the ENG button about 2-1/2 minutes after external power is plugged in or when the generator reaches operating speed, and hold it in until the green light comes on. After engagement, the equipment is placed in a standby condition by pushing the STANDBY button.

CAUTION

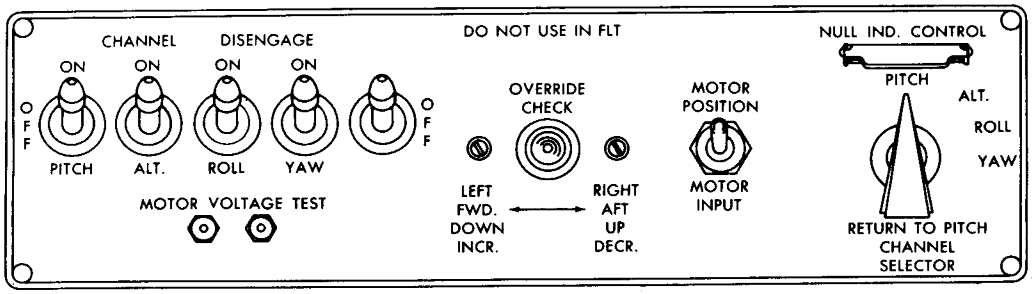
STANDBY button must be depressed before rotors stop turning after each flight (while generator power is available) to make sure that auxiliary servo pilot valves are not preset to an unknown position at next engine start.

2–35. The knob marked CG TRIM is used to trim the automatic stabilization pitch control before takeoff for actual cg location by moving the knob to the FWD or AFT positions, depending upon the location of the cg. Pitch control trim is shown by a pointer marked NULL IND, located at the bottom of the panel. During flight, the cg knob may be adjusted to keep the null indicator pointer near its center position. This adjustment will provide adequate pitching control through all conditions of flight. The knob marked YAW TRIM permits the pilot to accurately trim the heading of the helicopter for cruise with his feet off the tail rotor pedals. Index marks around the knob are alternately long and short, and rotating the knob from one mark to the next will change the heading of the helicopter 1 degree. One full revolution of the knob in either direction will produce a 36-degree change in heading of the helicopter. The position at which this knob is left is not important as the helicopter is always stabilized directionally. Although the tail rotor pedals may be slightly displaced, they may be used at any time by the pilot.

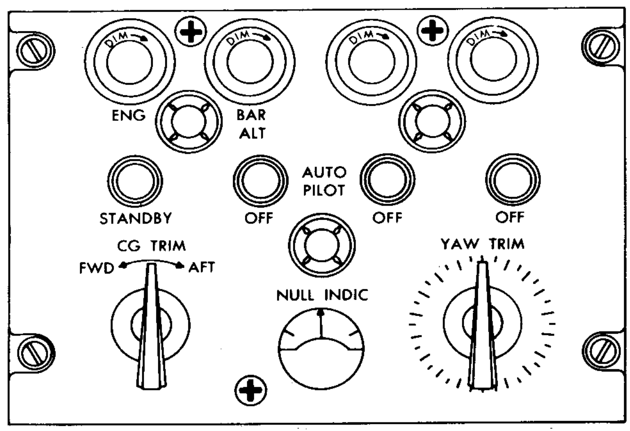
2–36. AUTOMATIC STABILIZATION RELEASE BUTTON. A momentary-on type push button is located on the pilot's and copilot's cyclic stick grip. The push button is marked AUTO STAB RELEASE. When pressed, the button disengages the automatic stabilization equipment. In order to reengage the automatic stabilization equipment, the ENG button on the automatic stabilization equipment control panel must be depressed.

2–37. MOTOR BOX CONTROL PANEL. The motor box control panel (figure 2–10) is located in the pilot's compartment between the pilot and copilot. The control panel has five lever lock-type switches marked CHANNEL DISENGAGE, one lever lock-type switch marked OVERRIDE CHECK, one switch marked MOTOR POSITION, MOTOR INPUT, and one guarded, rotary switch marked NULL IND CONTROL CHANNEL SELECTOR.

2–38. CHANNEL DISENGAGE SWITCHES. The four-channel disengage lever lock-type switches are located on the motor box control panel. The



MOTOR BOX CONTROL PANEL



ASE CONTROL PANEL

Figure 2-10. Automatic Stabilization Equipment

switches are marked PITCH, ALT, ROLL, and YAW, with ON and OFF positions, and are normally in the ON position. Lever lock-type switch number 5 is marked GOV and is a nonfunctional switch at this time. When the lever lock-type switches are in the OFF position, they will disengage any one of the ASE channels. The purpose of this arrangement is to prevent the necessity of complete shutdown of ASE in the event of one channel malfunctioning.

2-39. OVERRIDE CHECK SWITCH. The lever lock-type override check switch is located on the motor control panel. The switch is marked OVERRIDE CHECK with positions LEFT, FWD, DOWN, and INCR; RIGHT, AFT, UP, and DECR positions are also provided in order that the pilot may check the auxiliary servo pilot valve adjustment and the ability of the flight controls to override the automatic stabilization signals. When the switch is placed in either extreme position, the automatic stabilization equipment introduces steady signals on all four servo motors simultaneously. With the motors in this condition, the cyclic sticks and the collective pitch levers should be free to move to their limits in all directions; the tail rotor pedals will exert a limited force, but should be free to move to their limits with a maximum force of 40 pounds required in addition to the normal pedal damper restraint.

CAUTION

Do not operate override check switch in flight since this introduces simultaneous hard-over signals on all channels whether or not automatic stabilization equipment is engaged. Results of using this switch in flight are quite severe and should not be demonstrated.

2-40. MOTOR POSITION – MOTOR INPUT SWITCH. The motor position – motor input switch is located on the motor box control panel. The switch has two positions marked MOTOR POSITION and MOTOR INPUT. The switch selects the type

of information desired on the null indicator and is spring-held in MOTOR POSITION.

2–41. NULL INDICATOR CONTROL CHANNEL SELECTOR SWITCH. A guarded rotary channel selector switch is located on the motor box control panel. The switch is marked NULL IND CONTROL CHANNEL SELECTOR with positions PITCH, ALT, ROLL, and YAW. This switch is normally used during the ground automatic stabilization override check in conjunction with the null indicator on the ASE control panel. During normal flight the channel selector switch should be in the PITCH position in order to aid in adjusting the cg trim knob for actual cg location.

2–42. DESCRIPTION AND OPERATION OF NAVIGATION EQUIPMENT.

2–43. NAVIGATION EQUIPMENT. The navigation equipment for the various CH-34 helicopters consists of Antenna Group AN/ARA-31, LF Range Receiver, Radio Receiving Set AN/ARN-30A, Radio Compass AN/ARN-6, Automatic Direction Finder Set AN/ARN-59, Marker Beacon Receiver Set AN/ARN-12 or AN/ARN-32, and Glide Slope Receiver MN-100A.

2–44. DESCRIPTION OF ANTENNA GROUP AN/ARA-31. The Antenna Group AN/ARA-31 (12, figure 2–8) is installed in conjunction with the AN/ARC-44 system. The antenna group receives homing signals in the high frequency band of 24.0 to 49.0 megacycles. Its function is to provide navigational facilities by interpretation of homing signals. Principal components of the antenna group as installed are a keyer, two homing antenna bullets, and four antenna homing elements. The keyer samples the homing signals received by both bullets and transmits coded signals to the AN/ARC-44 system which permits an aural position fix with respect to the transmitter.

2–45. DESCRIPTION OF LF RANGE RECEIVER. The LF range receiver is continuously tunable in the frequency range of 190.0 to 550.0 kilocycles. The function of this radio set is to provide homing or direction finding facilities. Principal components of the LF range receiver as installed are a range receiver, a control panel, a loop antenna, and a wire antenna. The loop antenna (1, figure 2–8) is located on the top of the pilot's compartment, and the wire sense antenna (10, figure 2–8) is located on the bottom of the fuselage.

2–46. LF CONTROL PANEL. The LF control panel (figure 2–4), marked LF NAV, is located on the radio control console. The controls consist of an antenna selector switch marked LOOP-ANT, a tuning crank for mechanically tuning the range receiver, a SENS-OFF control to turn set on or off and to adjust the receiver sensitivity, and a tuning crank for mechanically controlling the rotation of the loop antenna. The position of the loop antenna is indicated by the calibrated dial. This dial is calibrated in increments of 10 degrees.

2–47. LF RANGE RECEIVER OPERATION. To turn set on and receive:

a. RADIO MASTER switch – ON.

b. Circuit breaker – CHECK.

c. SENS-OFF control – SENS. Rotate clockwise.

d. Antenna selector switch – ANT POSITION FOR COMMUNICATION SIGNALS, LOOP POSITION FOR NAVIGATION.

e. Tuning crank – DESIRED FREQUENCY.

f. SENS control (communication signals) – ADJUST FOR BEST SIGNAL-TO-NOISE RATIO.

g. SENS control (navigation signals) – ADJUST FOR SHARPEST MINIMUM SIGNAL.

h. Loop antenna – ROTATE. Adjust loop antenna and SENS control for sharpest minimum signal.

i. Bearing indicator dial – READ RELATIVE BEARING OF TRANSMITTING STATION.

CAUTION

Two nulls, 180-degrees apart, will be present. Correct heading may be determined in the following manner. If the general location of the transmitting station is known, take heading toward or away from as desired. If the general location of the transmitting station is unknown, take heading indicated on bearing indicator dial. Switch the antenna selector switch to the ANT position. Adjust receiver for minimum audible signal. If signal becomes weaker or fades permanently, aircraft is headed away from station. Take heading 180 degrees from heading indicated on bearing indicator dial. Switch antenna selector switch to LOOP position and adjust for correct indication on the bearing indicator dial.

To turn set off:

j. SENS-OFF control – OFF. Rotate fully counterclockwise.

2–48. DESCRIPTION OF RADIO RECEIVING SET AN/ARN-30A. Radio Receiving Set AN/ARN-30A is an airborne navigation –

communication receiving system designed for use with the following VHF facilities: VHF omni-direction range (VOR), visual-aural range (VAR), tone localizer (LOC), and voice reception on the complete band of frequencies covered within the range of 108.0 to 135.0 megacycles. The principal components as installed are a radio receiver, a signal data converter, a control panel, an indicator, and an antenna. The receiver is a nine-tube superheterodyne unit capable of being tuned to any amplitude-modulated signal within the frequency range. Aural output is provided for headset operation as well as for navigational signal output which is used in conjunction with the data converter. The data converter is designed to accept VOR, VAR, and LOC information delivered by the receiver and convert it to a form which is presented visually. The control panel (figures 2–5 and 2–7) marked VHF NAV consists of a tuning crank for remote tuning of the receiver, a volume control marked VOL-OFF for turning the set on or off and controlling the volume, and a switch marked OMNI-VAR LOC for selçcting VOR or VAR LOC signals. The course indicator is a combined cross-pointer indicator and course selector that provides bearing and position information. The horizontal (glide slope) pointer is inoperative on helicopters serial No. prior to 57-1742. On helicopters serial No. 57-1742 and subsequent, a cross-pointer indicator is installed on the copilot's side of the instrument panel. The AN/ARN-30A antenna (2, figure 2–8) is a "ram's horn" type and is mounted on top of the aft fuselage section.

2–49. AN/ARN-30A CONTROL PANEL. The AN/ARN-30A Control Panel (figures 2–5 and 2–7) marked VHF NAV is located on the radio console. The controls consist of a combination OFF-VOL control knob, a tuning crank and frequency dial, and a selector switch with positions OMNI and VAR LOC. A course indicator, located on the pilot's side of the instrument panel provides the bearing and its reciprocal of the navigation radio station, and lateral and vertical indications of the helicopter's position. The indicator also includes a TO-FROM meter that indicates position relative to the transmitting station. On Model CH-34C, serial No. 57-1742 and subsequent, a cross-pointer indicator is installed on the copilot's side of the instrument panel.

2–50. RADIO RECEIVING SET AN/ARN-30A OPERATION. To turn set on:

a. RADIO MASTER switch – ON.

b. AN/ARN-30A circuit breaker – CHECK.

c. No. 3 switch (switch panel) – ICS POSITION.

d. OFF – VOL control (AN/ARN-30A control panel) – ON. Rotate clockwise.

e. NAV receiver switch (signal distribution panel) – ON.

f. OMNI-VAR-LOC switch – AS REQUIRED.

g. Tuning crank – AS DESIRED.

h. OFF – VOL control – AS DESIRED.

To turn set off:

i. OFF – VOL control – OFF. Rotate fully counterclockwise.

2–51. DESCRIPTION OF RADIO COMPASS AN/ARN-6. Radio Compass AN/ARN-6 is an airborne navigational instrument which operates in the frequency range of 100.0 to 1750.0 kilocycles. The function of the radio compass is to guide the helicopter to a transmitting station at its destination or to take bearings on transmitting stations as an aid to navigation. Principal components of the set as installed are a receiver, a control panel, a loop antenna, and a wire antenna. The receiver is composed of the circuit elements which make up the compass circuit, a superheterodyne receiver circuit, the automatic loop control circuit, the vibrator power supply circuit, and the necessary circuits to provide for accurate tuning and aural identification of unmodulated radio signals. The control panel marked ADF RADIO, located on the instrument panel, contains a function switch, a four-position band selector switch with a frequency indicating dial calibrated in kilocycles, a tuning crank, a loop rotating knob, a volume control, and a continuous wave-voice switch. The course indicator indicates the position of the autosyn transmitter located in the loop and gives the bearing of the radio transmitter. The azimuth scale of the course indicator may be manually rotated by means of the VAR, located on the indicator. The loop antenna (9, figure 2–8) and the wire sense antenna (10, figure 2–8) are both mounted underneath the fuselage.

2–52. AN/ARN-6 CONTROL PANEL. AN/ARN-6 Control Panel (34, figure 2–10, Chapter 2) marked ADF RADIO is located on the instrument panel. Controls on the control panel consist of a function switch marked OFF ADF ANT LOOP CONT, a four position band selector switch with a frequency indicating dial calibrated in kilocycles, a tuning crank marked TUNING, a loop rotating control marked LOOP LR, a volume control marked VOLUME, and a continuous wave-voice switch marked CW-VOICE. The equipment may be used as a radio compass for homing or for direction finding by either the automatic or the aural-null

method. The receiver may also be used as a communication receiver. When the function switch is placed in the ADF position, the loop antenna is motor-driven to align itself automatically in the direction of the station that has been selected with the tuning crank, and the bearing is indicated on the course indicator. When the function switch is in the ANT position, the loop antenna and the course indicator are inoperative but signals may be received through the headsets. When the function switch is at LOOP, the loop antenna and course indicator are operative, but the loop motor must be controlled manually for direction finding by operating the loop-rotating control. Turning the loop control clockwise rotates the loop antenna and the course indicator pointer to the right, while turning the control counterclockwise rotates the loop antenna and the course indicator pointer to the left. The CONT position of the function switch is inoperative. The CW-VOICE switch, normally in the VOICE position, may be placed in the CW position to turn on a 900-cycle tone as an aid in tuning to stations that may be too weak to hear in the headsets, but still strong enough to give directional indication. Tune back and forth around the desired station and listen for zero beat, on either side of which a whistle will be heard. The course indicator located on the instrument panel consists of a fixed index at the top of the case, a compass card that may be rotated by turning the control marked VAR at the lower left of the indicator, and a pointer that indicates the direction of a signal source as determined by the loop antenna. The radio compass is connected to the signal distribution panels at the switch marked NAV.

2–53. RADIO COMPASS AN/ARN-6 OPERATION. To turn set on:

a. RADIO MASTER switch – ON.

b. AN/ARN-6 circuit breaker – CHECK.

c. No. 3 switch (switch panel) – ICS POSITION.

d. NAV switch (signal distribution panel) – ON.

e. Function switch – ADF ANT OR LOOP.

To tune set as a radio receiver:

f. VOL control – ROTATE CLOCKWISE.

g. Function switch – ANT.

h. Band selector switch – AS DESIRED.

i. CW-VOICE switch – CW POSITION. This is for aural reception of unmodulated signals as a tuning aid.

j. TUNING crank – ROTATE AS DESIRED.

k. VOL control – AS DESIRED.

Note

Use LOOP position on function switch if reception on ANT position is too noisy.

To operate loop antenna for aural-null direction finding:

l. EW VAR control (course indicator) – ROTATE UNTIL BEARING AT INDEX IS TRUE MAGNETIC HEADING OF HELICOPTER.

m. Function switch – LOOP.

n. CW-VOICE switch – CW FOR 900 CYCLE TUNING AID TONE.

o. VOL control – TUNE AND ADJUST.

p. LOOP L-R control – AS DESIRED. Turn left or right for minimum headset volume; bearing of transmitting station will be indicated on course indicator.

To operate as an automatic direction finder or homing compass:

q. E W VAR control (course indicator) – TRUE MAGNETIC HEADING FOR ADF OPERATION: ZERO INDEX FOR RADIO COMPASS.

r. Function switch – ADF.

s. CW-VOICE switch – CW.

t. VOL control – TUNE AND ADJUST.

To turn set off:

u. Function switch – OFF.

2–54. DESCRIPTION OF AUTOMATIC DIRECTION FINDER SET (ADF) AN/ARN-59. Automatic Direction Finder Set (ADF) AN/ARN-59 is an airborne radio compass system which operates in the frequency range of 190.0 to 1750.0 kilocycles. Its functions are to automatically provide visual indication of the direction from which an incoming radio-frequency signal is received and to aurally receive amplitude-modulated signals. It may also be used for homing and position fixing. Principal components of the ADF set as installed are a receiver, a control panel, two azimuth indicators, a loop antenna, and a wire antenna. The receiver is a 3-band superheterodyne unit containing 14 subminiature tubes and a transistor. Band selection is accomplished by remote control of a band switching dc motor through a speed reduction gear train. Remote tuning of the receiver is accomplished through a flexible mechanical linkage that interconnects the receiver and control panel. The control panel, marked ADF REC, and located on the instrument panel, is a console-type unit with selection of the three bands accomplished by a switch which actuates the band switching motor

in the receiver and switches to the proper frequency dial scale. Each of the 3 tuning bands can be covered by 29 turns of the tuning crank. The heremetically sealed azimuth indicators are synchro-driven instruments with azimuth scales graduated in 2-degree increments. The pointer and all markings are coated with a green phosphorescent material. The loop antenna (9, figure 2–8) is a heremetically sealed, glass covered assembly which incorporates a drive motor, a synchro transmitter, an adjustable compensating mechanism, and the antenna. The compensating mechanism corrects bearing errors caused by the helicopter's structure. The wire sense antenna (10, figure 2–8) is required as a reference to compare received signals with the received loop antenna signals in order to present a visual heading indication. Both antennas are located underneath the fuselage.

2–55. ADF CONTROL PANEL. The ADF control panel (38, figure 2–11, Chapter 2), marked ADF REC, is located on the instrument panel. The controls consist of an MC-BAND selector switch, a VOL-OFF control, a function switch, a LOOP switch, a tuning crank and meter, and an ON-BFO switch. The MC-BAND selector switch permits any one of three bands to be used. The VOL-OFF control turns the ADF set on or off, adjusts receiver audio level when the function switch is in COMP position, and adjusts receiver sensitivity when the function switch is in ANT or LOOP position. The function switch, marked COMP-ANT-LOOP, selects the various operations. When the switch is in COMP position, radio compass and audio range reception, using both antennas, are in operation; in ANT position, audio range reception, using the wire antenna, is in operation; and in LOOP position radio compass reception, using the ADF loop antenna, is in operation. The LOOP switch controls movement of the loop antenna in the direction desired. A tuning crank and meter provides a means for selecting a frequency, and an ON BFO switch turns the beat frequency oscillator on as a tuning aid when the function switch is in LOOP or ANT position. With the function switch in COMP position, the azimuth indicators show the relative bearing of the transmitting station with respect to the helicopter heading.

2–56. AUTOMATIC DIRECTION FINDER SET AN/ARN-59 OPERATION. To turn set on:

a. RADIO MASTER switch – ON.

b. AN/ARN-59 circuit breaker – CHECK.

c. No. 3 switch (switch panel) – ICS POSITION.

d. NAV switch (signal distribution panel) – ON.

e. VOL-OFF control – ON. Rotate clockwise.

To tune set as a radio receiver:

f. Function switch – ANT.

CAUTION

When tuning, be sure function switch is in ANT position to preclude damage to equipment.

g. MC-BAND selector switch – AS DESIRED.

h. ON-BFO switch – ON (FOR AURAL RECEPTION OF SIGNALS AS A TUNING AID).

i. Tuning crank – ROTATE.

j. VOL-OFF control – AS DESIRED.

Note

Use LOOP position on function switch if reception on ANT position is too noisy.

To operate loop antenna for aural-null direction finding:

k. EW VAR control (azimuth indicator) – ROTATE UNTIL BEARING AT INDEX IS TRUE MAGNETIC HEADING OF HELICOPTER.

l. Function switch – LOOP.

m. ON-BFO switch – ON.

n. VOL control – TUNE AND ADJUST.

o. LOOP switch – SWITCH LEFT OR RIGHT FOR MINIMUM HEADSET VOLUME. Bearing of transmitting station will be indicated on azimuth indicator. To operate as an automatic direction finder or homing compass:

p. E W VAR control (azimuth indicator) – TRUE MAGNETIC HEADING FOR ADF OPERATION; ZERO INDEX FOR RADIO COMPASS.

q. Function switch – COMP.

r. VOL-OFF control – TUNE AND ADJUST. Use tuning meter as an aid (tune for maximum indication).

To turn set off:

s. VOL-OFF control – OFF. Rotate counterclockwise.

2–57. DESCRIPTION OF MARKER BEACON RECEIVER SET AN/ARN-12 OR AN/ARN-32. Each marker beacon receiver set is an airborne, pretuned, radio navigation aid which receives an amplitude-modulated signal of 75.0 megacycles. Differences between the sets are internal. Set function is to receive signals transmitted by a ground beacon transmitter and deliver an aural and visual indication of the received signal. Com-

ponents of each set as installed are a VHF marker beacon receiver, a VHF volume control, a VHF marker beacon indicator lamp, and a VHF marker beacon antenna. The VHF marker beacon receiver utilizes a superheterodyne type of circuit. The VHF volume control, located on the instrument panel, turns the set on and permits volume adjustment. The amber VHF marker beacon indicator lamp, located to the right of the VHF volume control, is of a press-to-test type and provides a visual indication of the received signal. The signal is also heard in the headsets when the switch marked MB on the signal distribution panel is turned on. When the helicopter is in the field of a ground beacon transmitter with a z-type marker, the VHF marker beacon indicator lamp burns steadily and is accompanied by a high-pitched audio signal which reaches maximum directly over the transmitter. When the helicopter is in the field of a ground beacon transmitter with a fan-type marker, the VHF marker beacon indicator lamp flashes, matched by an audio signal. The VHF marker beacon indicator lamp and audio signal simultaneously correspond to a coded signal which identifies the beam and provides a positive check on distance from the transmitter. The VHF marker beacon indicator lamp and audio signal can operate independently in the event of failure of one or the other. The VHF marker beacon antenna (4, figure 2–8) mounted underneath the fuselage, receives the marker signals.

2–58. VHF MARKER BEACON INDICATOR LAMP AND VOLUME CONTROL PANEL. The VHF Marker Beacon Receiving Set AN/ARN-12 or AN/ARN-32 is controlled from a panel (28, figure 2–11, Chapter 2) located on the instrument panel. The panel marked MARKER BEACON has a volume control marked OFF-VOLUME, which adjusts the audio level of the marker beacon signal and turns set on or off. The amber indicator lamp is located to the right of the volume control. This lamp gives a visual indication of the marker beacon signal.

2–59. DESCRIPTION OF GLIDE SLOPE RECEIVER MN-100A. The Glide Slope Receiver MN-100A is an airborne navigation receiving system used in conjunction with Radio Receiving Set AN/ARN-30A. The system operates in the frequency range of 329.3 to 335.0 megacycles. Its function is to receive glide slope information to produce vertical guidance during instrument landings. Principal components of the set as installed are a receiver, a control unit, two course indicators, and an antenna. The receiver, located in the electronics compartment, is a fixed-frequency, superheterodyne type capable of any one of 20 carrier frequencies with a 300-kilocycle separation in the frequency band. The glide slope transmitter (on ground) sends a 150-cps modulated frequency pattern below the glide slope receiver and a 90-cps tone modulated carrier of the same frequency above the slide slope receiver. When the receiver is tuned to the glide slope transmitter, the signals are detected, amplified, separated by a filter, and rectified into proportional dc potentials, reflected on the course indicators in a manner depending on helicopter position. When the 90- or 150-cps signal predominates, the course indicator pointers will indicate direction for correction. The pointers will remain in normal rest position when the helicopter is on the glide slope receiver. The control unit, marked VHF NAV, is located on the radio console. Two course indicators, located on the instrument panel, reflect the helicopter position relative to the glide slope receiver. The antenna (11, figure 2–8), mounted on the left nose door, consists of four parallel conductors mounted in a brass housing with the entire assembly silver plated.

2–60. GLIDE SLOPE CONTROL PANEL. The glide slope control panel (figure 2–6), marked VHF NAV, is located on the radio control console. The controls consist of concentric knobs for volume, marked VOL, and frequency selection. The 20-channel receiver automatically sets up a particular channel when the corresponding localizer channel frequency is selected on the control panel. The AN/ARN-30A Course Indicator and cross-pointer indicator, used in conjunction with AN/ARN-30A operation, also provide continuous visual indication of the position of the helicopter with respect to the established glide slope when the glide slope receiver is operating.

2–61. GLIDE SLOPE RECEIVER MN-100A OPERATION. To turn set on and receive:

a. RADIO MASTER switch – ON.

b. Circuit breaker – CHECK.

c. VOL control – ROTATE CLOCKWISE.

d. Frequency selector control – AS DESIRED.

e. VOL control – AS DESIRED.

To turn set off:

f. VOL control – ROTATE FULLY COUNTER-WISE.

2–62. COURSE INDICATOR. The course indicator (21, figure 2–11, Chapter 2) is located on the pilot's side of the instrument panel. The course indicator has two bars which visually indicate VOR, VAR, or LOC information. The vertical bar is operated by Radio Receiving Set AN/ARN-30A

and moves laterally to give lateral guidance. The horizonal bar is operated by the glide slope receiver and moves vertically to give vertical guidance. Two warning flags, marked OFF, appear at the ends of the bars when signal levels decrease to the extent that the indication of the associated bar is unreliable or the receivers are off. A TO-FROM window indicates whether the course is to or from the station. A knob on the course indicator controls the movable index that selects a course on the azimuth scale on the course indicator.

2–63. CROSS-POINTER INDICATOR. On helicopters serial No. 57-1742 and subsequent, a cross-pointer indicator (1, figure 2–11, Chapter 2) is installed on the copilot's side of the instrument panel. This meter gives the same lateral, vertical, and warning flap information as the pilot's course indicator. However, the course cannot be selected and there is no TO-FROM window provided. A UHF marker beacon indicator lamp is located in the lower left-hand corner of the case.

2–64. DESCRIPTION AND OPERATION OF RADAR IDENTIFICATION EQUIPMENT.

2–65. DESCRIPTION OF IFF TRANSPONDER AN/APX-30. Space, weight, and power provisions are provided for the IFF Transponder AN/APX-30. The function of this set is to decode interrogation signals and transmit a coded reply. Principle components are an IFF receiver-transmitter, an IFF control panel, and an IFF antenna.

2–66. DESCRIPTION OF IFF TRANSPONDER AN/APX-44. Complete provisions are provided for the IFF Transponder AN/APX-44. The function of this set is to decode interrogation signals and transmit a coded reply. Principle components are an IFF receiver-transmitter, an IFF control panel, and an IFF antenna.

CHAPTER 6
AUXILIARY EQUIPMENT
SECTION I
SCOPE

1-1. GENERAL.

1-2. This chapter contains information on all auxiliary equipment that is not electronically operated and does not affect the flying characteristics of the helicopter. The information is of a nontechnical nature, being designed merely to instruct the crew on the basic operation of equipment and any emergency instructions that may apply.

1-3. When the equipment discussed contributes to the ability of the helicopter to perform a specialized mission, a description of that mission is also included.

SECTION II
HEATING AND VENTILATING SYSTEM

2-1. HEATING SYSTEM.
(See figure 2-3, Chapter 2.)

2-2. Heat is supplied by a 50,000 BTU internal combustion heater unit which is located in the upper part of the tail cone. The heater unit operates on fuel from the main fuel system. Fuel is pumped from the forward fuel tank by a heater fuel pump to the heater (15) where it is ignited by a spark plug. The spark plug operates on current developed by a heater ignition unit mounted on the tail cone structure beside the heater. After combustion, exhaust gases are expelled through a heater exhaust (16). The heater and heater fuel pump operate on direct current from the secondary bus. A fan in the heater draws air from inside the tail cone and forces the air through a heat exchange unit surrounding the combustion unit. The heated air is then forced forward into a plenum chamber aft of the electronics compartment and through two ducts which extend along the cabin walls and into the pilots' compartment. The ducts contain six registers in the cabin and two registers in the pilots' compartment. A perforated flexible duct (7, figure 2-4, Chapter 2), connected to the forward end of each duct, supplies heated air for windshield defogging. The windshield defogger is automatically in operation whenever the heating system is operating. The heater fan may be operated separately from the system for ventilation. (Refer to paragraph 2-11.) The heating system is illustrated in figure 2-1.

2-3. CABIN HEATER SWITCH. (See figure 2-20, Chapter 2.)

2-4. The heating system is operated by a switch located on the overhead switch panel. The switch is marked CABIN HEAT and has three positions, marked HIGH, LOW, and OFF. The heater switch controls the heater fuel pump, the ignition unit, and the fan by means of direct current from the secondary bus. When the switch is in the LOW position, the heater will automatically maintain a temperature of approximately 65°C (150°F) in the plenum chamber. The HIGH position will automatically maintain a temperature of approximately 140°C (285°F). An overheat switch will shut the heater off if, for any reason, the heat in the plenum chamber rises to 176°C (350°F). The heater will also shut off if the fan fails to operate.

2-5. HEATING AND VENTILATING REGISTERS.

2-6. Six registers are located in the heater ducts in the heating and ventilating system (figure 2-1) which extend along the sides of the cabin near the ceiling. Two registers are located in the ducts which extend along the outer sides of the pilots' compartment just above the floor.

2-7. HEATING AND VENTILATING REGISTER KNOBS. The register knobs, marked OPEN and CLOSED, are used to regulate the flow of warm air through the registers into the pilots' compartment or cabin.

2-8. NORMAL OPERATION.

a. Vent fan switch – ON.

b. Heater switch – HIGH OR LOW.

c. Heater registers – ADJUST AS DESIRED.

Note

Heater is shut off by moving heater switch to OFF. Fan will continue to operate after heater is shut off until temperature in plenum chamber drops below 49°C (120°F). If temperature in plenum chamber should rise above 49°C (120°F) during hot weather, fan will begin to operate when secondary bus is energized.

2-9. EMERGENCY OPERATION.

2-10. If the heater shuts off because of an overheat condition, turn the heater switch to OFF and open all registers to allow the fan to dissipate the heat, and then place the switch in the HIGH or LOW position if continued operation is desired.

2-11. VENTILATING SYSTEM.
(See figure 2-1.)

2-12. The ventilating system utilizes the heater air intake, fan, and ducts to circulate cooling air through the interior of the helicopter. Windshield defogging can be accomplished by means of the ventilating system.

2-13. VENT FAN SWITCH. (See figure 2-20, Chapter 2.)

2-14. The vent fan switch is located on the overhead switch panel. The switch has two positions,

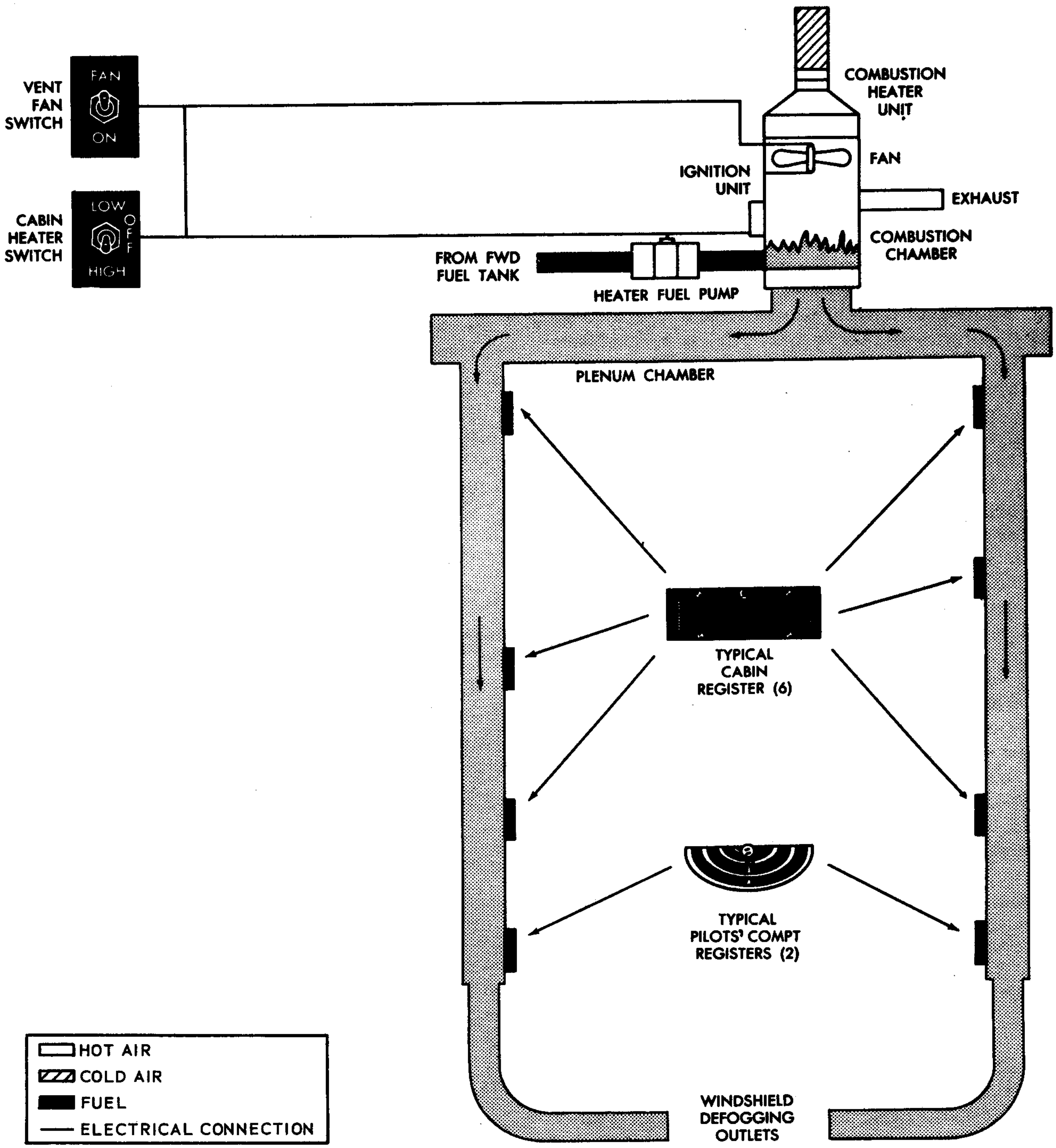


Figure 2-1. Heating and Ventilating System

FAN (off) and ON. The vent fan operates on direct current from the secondary bus.

2-15. CABIN AIR VENTS. (See figure 2-2, Chapter 2.)

2-16. Cabin air vents (24) are installed at the rear of each cabin wall slightly above floor level. Each vent is equipped with a screen and a lever to adjust the vent.

2-17. CABIN AIR VENT LEVER. (See figure 2-2.) When the cabin air vent lever is forward, the vent is CLOSED. When the lever is aft, the vent is OPEN.

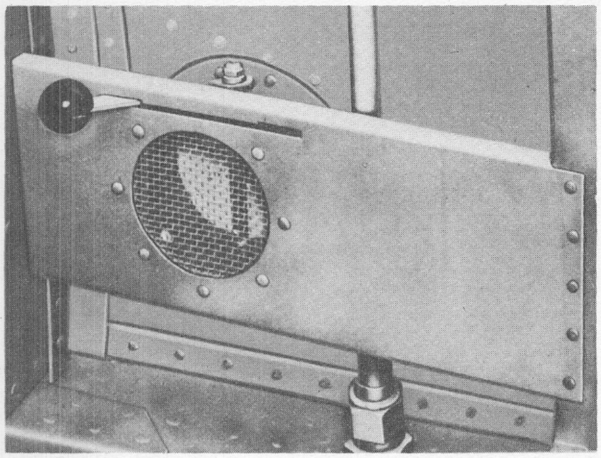


Figure 2-2. Cabin Air Vent Lever

2-18. PITOT HEATER.

2-19. PITOT HEATER SWITCH. (See figure 2-20, Chapter 2.)

2-20. A pitot heater switch is located on the overhead switch panel. The switch is marked PITOT HEAT (off) and ON. When the switch is in the ON position, it actuates the electric heater on the pitot head. When the switch is in the PITOT HEAT position power is cut off to the electric heater. The heater operates on direct current from the primary bus and is used to prevent the formation of ice inside and on the pitot tube.

SECTION III
LIGHTING EQUIPMENT

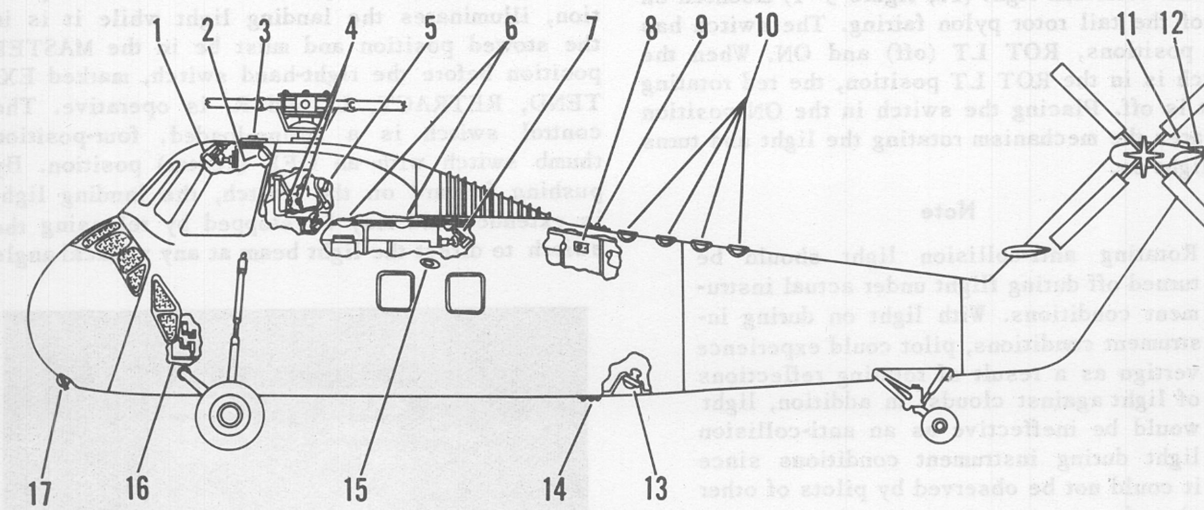
3-1. LIGHTING EQUIPMENT.
(See figure 3-1.)

3-2. All lights operate on direct current through circuits protected by circuit breakers. The pilots' compartment dome light (2) and spotlight (1) and the oil level inspection lights (4, 5, and 16) operate from the battery bus through a circuit breaker, marked CKPT DOME LT, located on the battery bus circuit breaker box. (See figure 2-22, Chapter 2.) These lights may be turned on at any time. All other pilots' compartment interior lights operate from the primary bus. All cabin and exterior lights and the landing light (17, figure 3-1) operate from the secondary bus. Primary and secondary bus circuit breakers for lighting equipment are located on the overhead circuit breaker and fuse panel (figure 2-21, Chapter 2) in the pilots' compartment.

3-3. EXTERIOR LIGHT SWITCHES. (See figure 2-20, Chapter 2.)

3-4. Four exterior light switches are located on the overhead switch panel and control the exterior lights. Three switches are marked EXTERIOR LIGHTS; the fourth is marked ROT LT ON.

3-5. Three of the position lights (3, 9, and 14, figure 3-1) are white, one located on top of the pilots' compartment canopy, one aft of the main gear box fairing, and one on the bottom of the fuselage. The other three position lights (15 and 12) are colored: a green light on the right side of the fuselage, a red light on the left side, and a yellow light at the aft end of the tail gear box fairing. The two switches at the left, marked POSITION, control the six position lights. The left-hand switch



1. Pilots' Compartment Spotlight
2. Pilots' Compartment Dome Light
3. Position Light (White)
4. Main Gear Box and Primary Servo Inspection Lights
5. Auxiliary Servo Reservoir Oil Level Inspection Light (Helicopters Serial No. 56-4313 and Subsequent)
6. Cabin Dome Lights
7. Cabin Spotlight
8. Electronics Compartment Dome Lights
9. Position Lights (White)
10. Formation Lights
11. Rotating Anti-Collision Light
12. Position Light (Yellow)
13. Cargo Floodlight
14. Position Light (White)
15. Position Light (Left Side Red; Right Side Green)
16. Auxiliary Servo Reservoir Oil Level Inspection Light (Helicopters Serial No. Prior to 56-4313
17. Landing Light

Figure 3-1. Lighting Equipment

has two positions, DIM and BRT; the right-hand switch has three positions, FLASH, OFF, and STEADY. When the right-hand position light is placed in the FLASH position, the three white position lights flash alternately with the three colored position lights at 40 cycles per minute. When this switch is placed in the STEADY position, the position lights are on, but not flashing.

3–6. FORMATION LIGHT SWITCH. (See figure 2–20, Chapter 2.)

3–7. The right-hand exterior formation light switch is located on the overhead switch panel. The switch is marked FORM, and controls the four formation lights (10, figure 3–1) located on top of the fuselage and tail cone. The switch has three positions, DIM, OFF, and BRT. The switch is placed in the BRT position to turn on the formation lights. When the switch is placed in the DIM position, the current flows through a resistor dimming the formation lights.

3–8. ROTATING ANTI-COLLISON LIGHT SWITCH. (See figure 2–20, Chapter 2.)

3–9. The rotating anti-collision light switch is located on the overhead switch panel. The switch is marked ROT LT and ON and controls a red rotating anti-collision light (11, figure 3–1) mounted on top of the tail rotor pylon fairing. The switch has two positions, ROT LT (off) and ON. When the switch is in the ROT LT position, the red rotating light is off. Placing the switch in the ON position actuates the mechanism rotating the light and turns the light on.

Note

Rotating anti-collision light should be turned off during flight under actual instrument conditions. With light on during instrument conditions, pilot could experience vertigo as a result of rotating reflections of light against clouds. In addition, light would be ineffective as an anti-collision light during instrument conditions since it could not be observed by pilots of other aircraft.

3–10. PILOT'S CARGO FLOODLIGHT SWITCH. (See figure 2–20, Chapter 2.)

3–11. A pilot's cargo floodlight switch is located on the overhead switch panel in the pilots' compartment. The switch is marked CARGO FLD LT with three positions, PILOT, OFF, and CREW; and controls the cargo floodlight. When the switch is placed in the PILOT position, the light is turned on. When the switch is placed in the CREW position, the light may be controlled from a switch in the cabin. The pilot may turn the cargo floodlight on or off at any time, but the cabin switch is operative only when the pilot's switch is in the CREW position. The cargo floodlight (13, figure 3–1) is focused to illuminate directly below the cargo door when the helicopter is 30 feet above ground, and is fixed in the bottom structure of the fuselage below the electronics compartment.

3–12. CREW CARGO FLOODLIGHT SWITCH. (See figure 3–2.)

3–13. A crew cargo floodlight switch is located on a crew light switch panel located over the cabin door. The switch is marked CARGO FLOOD LIGHT and has two marked positions, ON and OFF. The cabin switch will turn the cargo floodlight on and off only when the cargo floodlight switch in the pilots' compartment is placed in the CREW position. Power is supplied from the secondary bus.

3–14. LANDING LIGHT SWITCH. (See figure 3–3.)

3–15. Two landing light switches are located on the landing light control box at the end of the pilot's collective pitch lever. The switches are marked LDG LT and operate a swivel-type landing light (17, figure 3–1) located in the left nose door. The left-hand toggle switch, marked MASTER, OFF, and RETRACT, when placed in the MASTER position, illuminates the landing light while it is in the stowed position and must be in the MASTER position before the right-hand switch, marked EXTEND, RETRACT, L, and R, is operative. The control switch is a spring-loaded, four-position thumb switch with an OFF (center) position. By pushing forward on the switch, the landing light is extended and may be stopped by releasing the switch to direct the light beam at any vertical angle

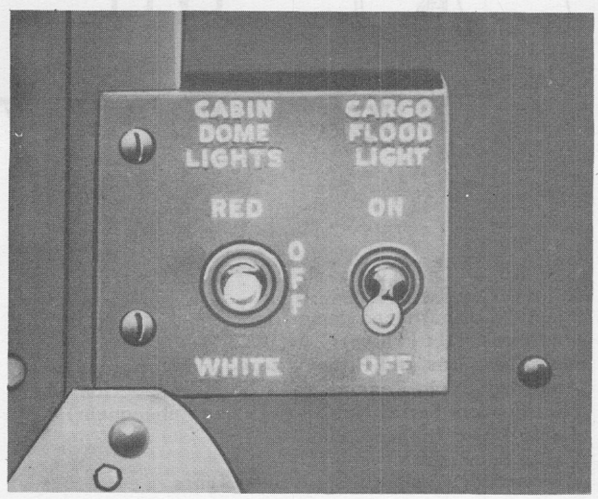


Figure 3–2. Cabin Dome Light and Cargo Floodlight Switches

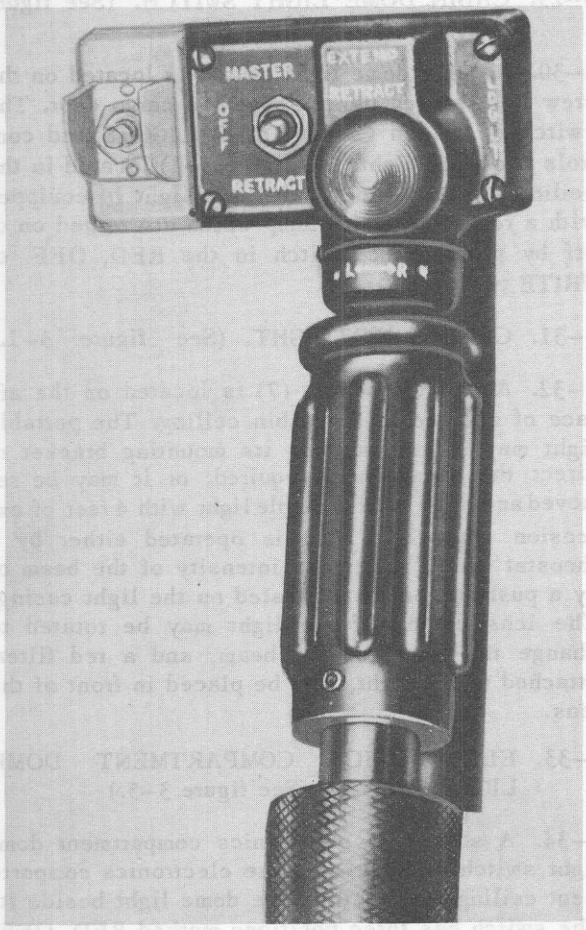


Figure 3–3. Landing Light Switches

straight ahead between the stowed position (approximately 60 degrees below the horizon) to 30 degrees above the horizon. By pushing aft on the switch, the light beam may be directed at a progressively decreasing angle until the light reaches the fully stowed position. By pushing to either side on the switch and releasing it at the proper time, the landing light will rotate to the right or to the left to any point in 360 degrees. If the master switch is placed in the RETRACT position while the landing light is extended, the landing light will turn off and will automatically retract to the stowed position; the switch is then released to the OFF (center) position.

3–16. PILOTS' COMPARTMENT DOME LIGHT SWITCH AND RHEOSTAT. (See figure 3–4 and figure 2–20, Chapter 2.)

3–17. A pilots' compartment dome light switch (figure 3–4) is located next to the dome light on the dome light panel which is situated in the pilots' compartment. The guarded switch is marked DOME

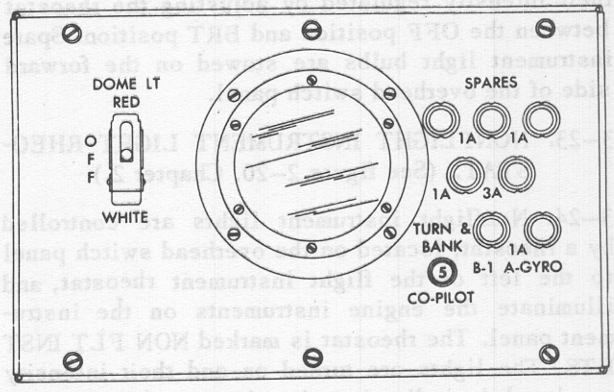


Figure 3–4. Pilots' Compartment Dome Light Panel (Typical)

LT, and has three marked positions, RED, OFF, and WHITE. The dome light is equipped with a red and a white lamp. The red lamp may be turned on at any time by moving the switch to RED. The intensity of the red dome lamp may be regulated by adjusting the rheostat, marked INST FLD LTS, The lights are turned on and their intensity regulated by adjusting the rheostat between the OFF position and BRT position. Spare instrument flight bulbs are stowed on the forward side of the overhead switch panel.

3–18. PILOTS' COMPARTMENT SPOTLIGHT. (See figure 3–1.)

3–19. A pilots' compartment spotlight (1) is located forward of the overhead switch panel in the pilots' compartment. The portable spotlight may be adjusted on its mounting to direct the light beam where required, or it may be removed and and used as a portable light with 4 feet of extension cord. The light is operated either by a rheostat which turns on and varies the intensity of the light or by a push button, both located on the light casing. The lens casing of the light may be rotated to focus the beam. A red filter, attached to the light, may be placed in front of the lens.

3–20. On Model CH-34C serial No. 57–1742 and subsequent, the pilots' compartment spotlight is located on the left side of the overhead switch panel.

3–21. FLIGHT INSTRUMENT LIGHT RHEOSTAT. (See figure 2–20, Chapter 2.)

3–22. The flight instrument lights are controlled by a rheostat, located on the overhead switch panel, and illuminate the pilot's and copilot's flight instruments on the instrument panel and the standby compass. The rheostat is marked FLT INST LTS. The lights are turned on and

their intensity regulated by adjusting the rheostat between the OFF position and BRT position. Spare instrument light bulbs are stowed on the forward side of the overhead switch panel.

3–23. NONFLIGHT INSTRUMENT LIGHT RHEOSTAT. (See figure 2–20, Chapter 2.)

3–24. Nonflight instrument lights are controlled by a rheostat, located on the overhead switch panel to the left of the flight instrument rheostat, and illuminate the engine instruments on the instrument panel. The rheostat is marked NON FLT INST LTS. The lights are turned on and their intensity regulated by adjusting the rheostat between the OFF position and BRT position. Spare instrument light bulbs are stowed on the forward side of the rheostat, located on the overhead switch panel to the left of the flight instrument rheostat, and illuminate the engine instruments on the instrumentpanel. The rheostat is marked NON FLT INST LTS. The lights are turned on and their intensity regulated by adjusting the rheostat between the OFF position and BRT position. Spare instrument light bulbs are stowed on the forward side of the overhead switch panel.

3–25. WARNING LIGHT DIMMING SWITCH. (See figure 2–16. Chapter 2.)

3–26. A warning light dimming switch is located on the main switch panel. The switch is marked WARN LTS. The switch is spring-loaded to the center position and the momentary positions are marked BRT and DIM. The switch is used to control the intensity of the warning lights when the flight instruments are being used. Normally, the warning lights are bright, but if it is desired to dim them when the flight instrument lights are being used, the switch is moved momentarily to the DIM position. The lights will remain dim until the switch is placed momentarily in the BRT position. When the flight instrument light rheostat is turned off or electrical power is turned off, the warning lights will automatically return to bright.

3–27. CONSOLE AND PANEL LIGHT RHEOSTAT. (See figure 2–20, Chapter 2.)

3–28. The red lights on the radio control panels, the overhead switch panel, the main switch panel, and the checkoff list are controlled by a rheostat, located to the left of the instrument light rheostats on the overhead switch panel. The rheostat is marked CONSOLE & PANEL LTS. The lights are turned on and their intensity regulated by adjusting the rheostat between the OFF and BRT positions. Spare panel light bulbs are stowed at the left on the forward side of the overhead switch panel.

3–29. CABIN DOME LIGHT SWITCH. (See figure 3–2.)

3–30. A cabin dome light switch is located on the crew light switch panel above the cargo door. The switch is marked CABIN DOME LIGHTS and controls two dome lights (6, figure 3–1) located in the ceiling of the cabin. Each dome light is equipped with a red and a white lamp which are turned on or off by placing the switch in the RED, OFF, or WHITE position.

3–31. CABIN SPOTLIGHT. (See figure 3–1.)

3–32. A cabin spotlight (7) is located on the aft face of a frame in the cabin ceiling. The portable light may be adjusted on its mounting bracket to direct the beam where required, or it may be removed and used as a portable light with 4 feet of extension cord. The light is operated either by a rheostat which varies the intensity of the beam or by a push button, both located on the light casing. The lens casing of the light may be rotated to change the focus of the beam, and a red filter, attached to the light, may be placed in front of the lens.

3–33. ELECTRONICS COMPARTMENT DOME LIGHT SWITCH. (See figure 3–5.)

3–34. A slide-type electronics compartment dome light switch is located in the electronics compartment ceiling and controls the dome light beside it. The switch has three positions marked RED, OFF, and WHITE. Two spare bulbs are stowed forward of the light.

3–35. OIL LEVEL INSPECTION LIGHT SWITCHES.

3–36. The oil level inspection light switch (figure 3–6) for the oil level sight gages of the main

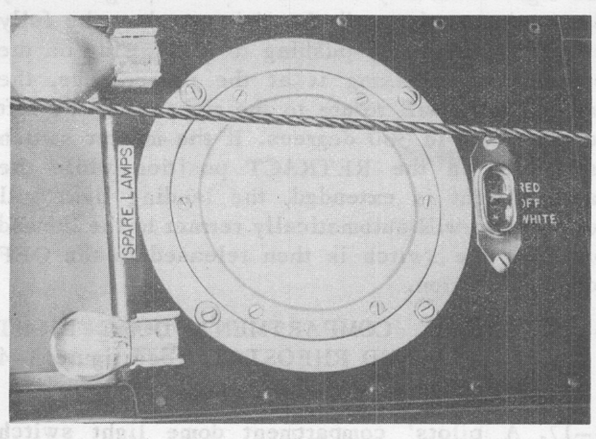


Figure 3–5. Electronics Compartment Dome Light Switch

gear box and the primary servo hydraulic reservoir, located on the left side of the transmission compartment, is a push-button type switch, located on the forward gear box support tube. An additional light switch is mounted over the copilots' right on the canted bulkhead in the cockpit, and this switch also operates the primary hydraulic system reservoir light and the main gear box light. The oil level inspection light switch (figure 3–7) for the oil level sight gage of the auxiliary servo hydraulic reservoir, located on the lower left-hand corner of the cabin wall, is a push-button type switch, located on the tank housing. Both switches are marked OIL LEVEL INSP LT.

3–37. On helicopters serial No. 56–4313 and subsequent and Model CH-34C, the oil level inspection light switch (figure 3–8) for the oil level sight gage of the auxiliary servo hydraulic reservoir, located on the right-hand side of the transmission housing, is a push-button type switch, located on the right side of the forward transmission bulkhead. The switch is marked OIL LEVEL INSP LT.

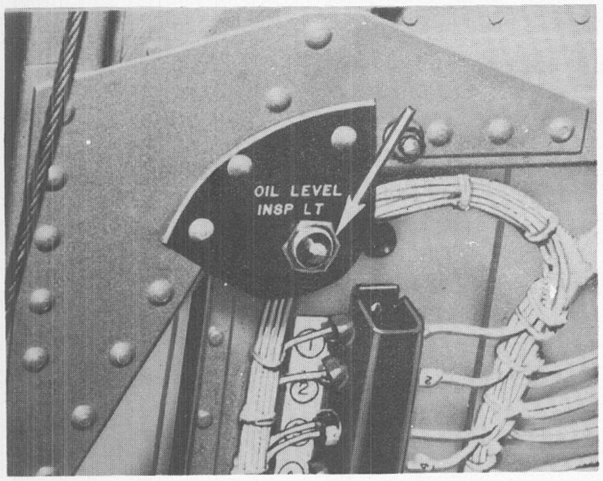


Figure 3–6. Main Gear Box and Primary Servo Hydraulic Reservoir Oil Level Inspection Lights Switch

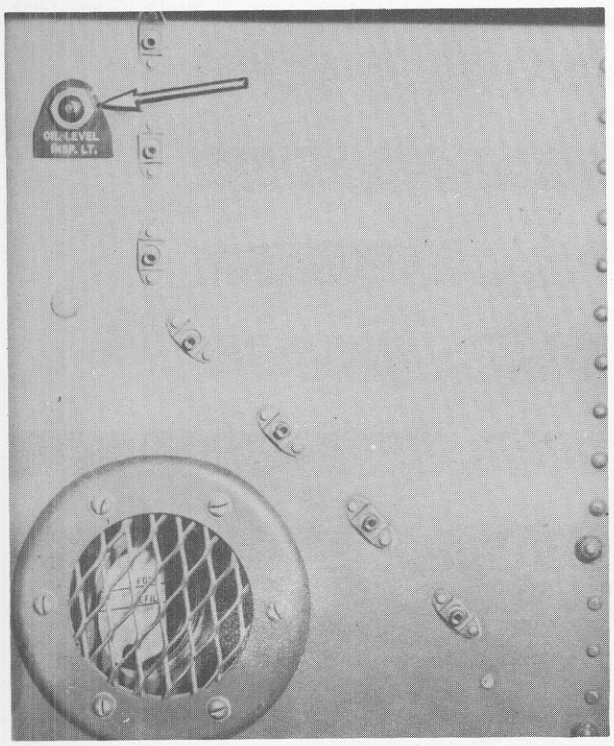


Figure 3–7. Auxiliary Servo Hydraulic Reservoir Oil Level Inspection Light Switch (Model CH-34A Serial No. Prior to 56-4313)

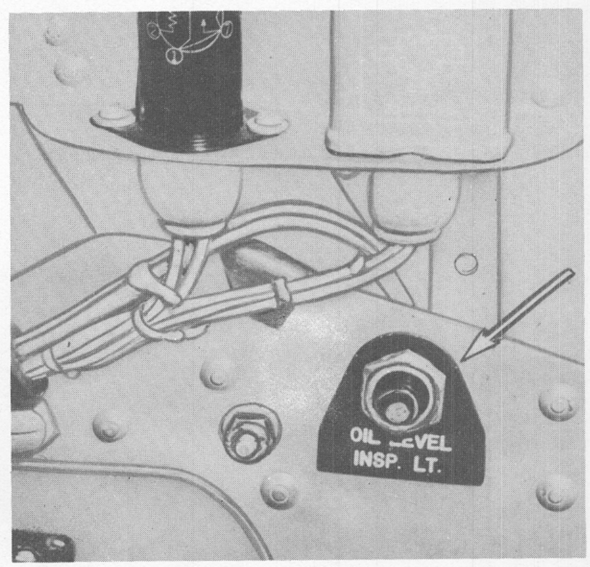


Figure 3–8. Auxiliary Servo Hydraulic Reservoir Oil Level Inspection Light Switch (Helicopters Serial No. 56-4313 and Subsequent and Model CH-34C)

SECTION IV

CARGO LOADING, TROOP CARRYING, AND CASUALTY CARRYING EQUIPMENT

4–1. CARGO CARRYING EQUIPMENT.

4–2. CABIN.

4–3. The cabin is approximately 11 feet long, 5-1/2 feet wide, and 6 feet high. The cabin sliding door in the right side of the fuselage is 52 inches wide by 48 inches high. The cabin floor is approximately 34 inches above ground level and will support up to 200 pounds-per-square-foot. Raised strips are provided to protect the floor and to facilitate cargo handling. Thirty-four tiedown rings, capable of resisting 1200 pounds pull in any direction, are located at intervals in the cabin floor. Ten cargo tiedown straps are stowed in a pocket between frames at floor level.

4–4. EXTERNAL CARGO SLING. (See figure 4–1.)

4–5. An external cargo sling of 4000 pounds capacity on helicopters serial No. 53-4475 through 55-4504 and of 5000 pounds capacity on helicopters serial No. 56-4284 and subsequent may be attached below the fuselage. The sling consists of four cables converging on a hook assembly. The hook will automatically release loads of from 120 to 5000 pounds upon contact with the ground. Thumb switches on the pilot's and copilot's cyclic stick grips must be used to release loads less than 120 pounds and can be used to release loads up to 5000 pounds before ground contact. The sling hook may also be opened mechanically by depressing a foot-operated release pedal (figure 4–2) on the floor at the right of the pilots' seat. A handle is provided to manually open the sling hook on the ground. For a pickup, the helicopter must be hovered or taxied over the load and the load attached to the hook from the outside of the helicopter. The cargo sling is stowed against the bottom of the helicopter of the left side by pulling a stowing line, which enters the cabin through the left side panel, and securing it around a chock.

CAUTION

Cargo sling should be stowed before landing to prevent striking hook on ground. Continuous striking of hook on ground may cause damage and subsequent failure of the hook assembly.

4–6. A plastic observation window, installed in the floor of the cabin, affords the crew an unobstructed view of the cargo sling and the ground below, thus facilitating cargo handling operations. When not in use, the window is covered by a hinged section of the floor, held in place by Camloc fasteners. A readily removable cover on the underside of the fuselage prevents damage to the window from the outside.

4–7. CARGO SLING MASTER SWITCH AND WARNING LIGHT. (See figure 2–13, Chapter 2.) A cargo sling master switch is located in the pilots' compartment on the right side of the radio control console and controls the electrical operation of the cargo sling hook. The switch is marked MASTER CARGO SLING with three marked positions, ON, SAFE, and AUTO. The master switch should always be kept in the SAFE position when loading or during flights to prevent accidental automatic discharge of the cargo due to gusts. The ON position energizes the two thumb switches on the cyclic stick grips which enable the pilot or copilot to release the load on the sling. The AUTO position energizes the thumb switches and also a switch on the cargo hook which automatically releases loads when the helicopter descends until the load contacts the ground and the tension on the support cables drop to approximately 120 pounds or below. On early model helicopters, a switch is located on the upper right-hand corner of the overhead switch panel in the pilots' compartment. The switch is marked MASTER CARGO SLING with three marked positions, CARGO SLING, SAFE, and AUTO. The CARGO SLING position functions the same as the ON position in later model helicopters. The cargo sling master switch should not be placed in the AUTO position when carrying loads of less than 120 pounds or the hook will open. After the load is released, the switch should be returned to the SAFE position and the sling stowed. The cargo hook solenoid operates from the primary bus.

4–8. A press-to-test warning light forward and to the right of the master switch will light when there is power in the system and the cargo hook is open.

4–9. CARGO RELEASE BUTTON. (See figures 2–27 and 2–28, Chapter 2.) A push-button switch

Figure 4–1. External Cargo Sling

on either cyclic stick grip is depressed to electrically open the cargo hook. The switch is marked CARGO. The switches will release the load only when the cargo sling master switch on the control console is placed in the ON or AUTO position.

4–10. CARGO SLING RELEASE PEDAL. (See figure 4–2.) A foot-operated release pedal is located on the pilots' compartment floor at the right of the pilot's seat. The pedal may be depressed to open the cargo sling hook mechanically in an emergency or when the electrical circuit is inoperative. The load will be released in the air or on the ground regardless of the position of the cargo sling switch.

4–11. CARGO SLING OPERATION.

4–12. To attach cargo:

a. Cargo sling master switch – SAFE.

b. While hovering: GROUND PERSONNEL OPEN HOOK, INSERT CARGO ATTACHING CABLES, AND CLOSE HOOK MANUALLY.

4–13. To release load of under 120 pounds:

a. Cargo sling master switch – ON.

b. Cargo release button (cyclic stick grip) – DEPRESS.

c. Cargo sling master switch – SAFE.

d. Pilot – INSTRUCT CABIN OCCUPANTS TO STOW CARGO SLING.

4–14. To release load of over 120 pounds. Proceed as above or:

a. Cargo sling master switch – AUTO.

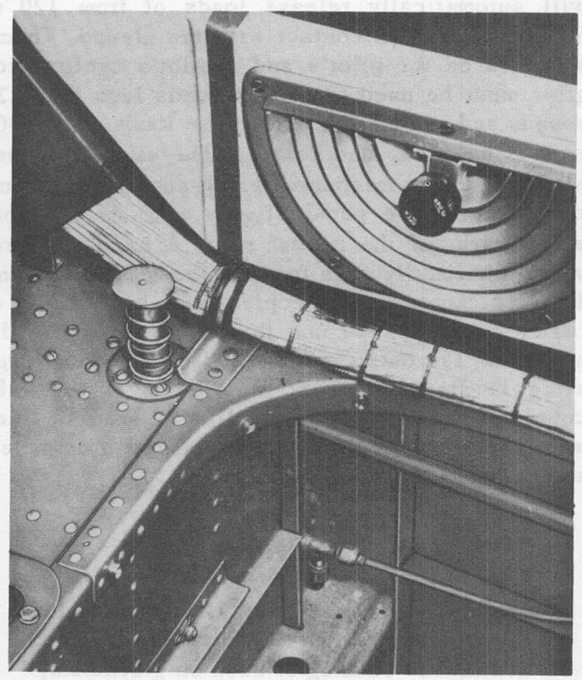


Figure 4–2. Cargo Sling Release Pedal

b. Descend slowly with minimum forward speed and no side drift until cargo rests on ground and cargo attaching cables slacken; hook should open automatically.

c. Climb.

d. Cargo sling master switch – SAFE.

e. Pilot – INSTRUCT CABIN OCCUPANTS TO STOW CARGO SLING.

4–15. CARGO SLING EMERGENCY OPERATION. Cargo hook may be opened at any time by depressing release pedal on floor at right of pilot's seat or may be opened manually by ground personnel.

4–16. RESCUE HOIST. (See figure 4–3.)

4–17. A 600-pound capacity hydraulic hoist winch with approximately 95 feet of cable is mounted on a fixed stand above and outside the cabin door. Powered by a hydraulic pump, driven by the main gear box, the system utilizes hydraulic fluid from the flight control primary servo reservoir. The hoist winch incorporates a load-holding brake which locks automatically whenever the winch stops, and a level-wind mechanism which prevents snarling if the cable is wound in rapidly with no load attached it it. Microswitches stop the reel before the cable is completely reeled in or out. An electrically operated cartridge-type guillotine, controlled by switches in the pilots' compartment and the cabin, will cut the hoist cable at the winch in case the hook becomes entangled in an obstruction on the ground and cannot be released. The hoist hook is manually opened by pulling down on the spring-loaded lever. The hook incorporates a handhold as an aid to rescued personnel and is self-stowing when the cable is reeled completely in. The hoist winch may be controlled by switches. Since the hoist hydraulic pump is driven by the main gear box, the hoist can be operated only when the main rotor is turning.

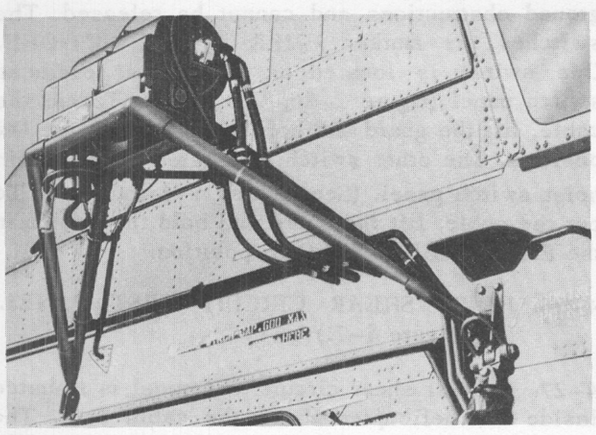


Figure 4–3. Rescue Hoist

4–18. HOIST MASTER SWITCH. (See figure 2–20, Chapter 2.)

4–19. The hoist master switch is located on the pilots' overhead switch panel. The switch is marked HOIST with positions, CREW, OFF, and PILOT. When the switch is placed in the CREW position, the hoist winch may be operated by the crew using the hoist switch installed in the cabin (figure 4–4 and 4–5) or by the pilot using the hoist switch on the cyclic stick grip. (See figure 4–6.) When the master switch is placed in the PILOT position, the hoist is controlled only by the pilot. When the switch is left in the OFF position, both winch switches are inoperative, but both the pilot's and the cabin emergency cable cutoff switches can

Figure 4–4. Cabin Hoist Switch and Emergency Cable Cutoff Switch (Helicopters Serial No. Prior to 57-1684)

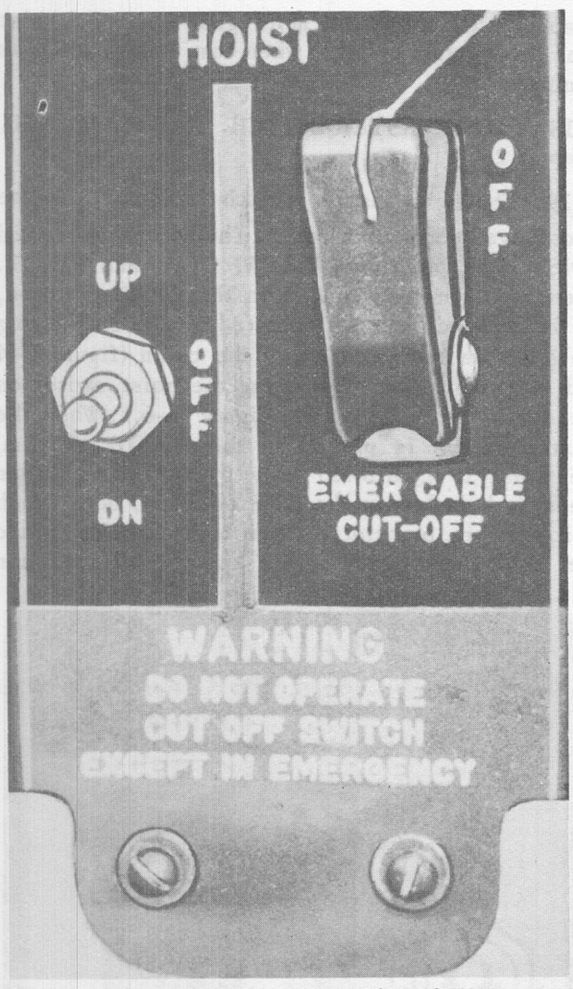


Figure 4–5. Cabin Hoist Switch and Emergency Cable Cutoff Switch (Helicopters Serial No. 57-1684 and Subsequent)

be operated. Both hoist winch switches are inoperative while either the pilot's or the cabin emergency cable cutoff switch is in operation.

4–20. PILOT'S HOIST SWITCH. (See figure 4–6.

4–21. The pilot's hoist switch is located on the pilot's cyclic stick grip and permits pilot control of the hydraulic hoist winch. The switch is marked HOIST with positions UP and DOWN. The switch is pushed to either position to operate the hoist. When the switch is released, it returns to the center (off) position and the hoist winch then stops and locks. The switch is inoperative unless the hoist master switch is placed in the CREW or PILOT position.

4–22. CABIN HOIST SWITCH. (See figures 4–4 and 4–5.)

4–23. A cabin hoist momentary-type switch on the left side of a small panel, marked HOIST, is located above the door on the right side of the cabin. The switch has three positions marked UP, OFF, DN. It enables a crewmember to control the hoist. The switch is pushed to either extreme, UP or DN, to operate the hoist winch. When the switch is released, it returns to the OFF position. The hoist winch then stops and locks automatically. The switch can be operated only if the hoist master switch on the pilots' overhead switch panel is placed in the CREW position.

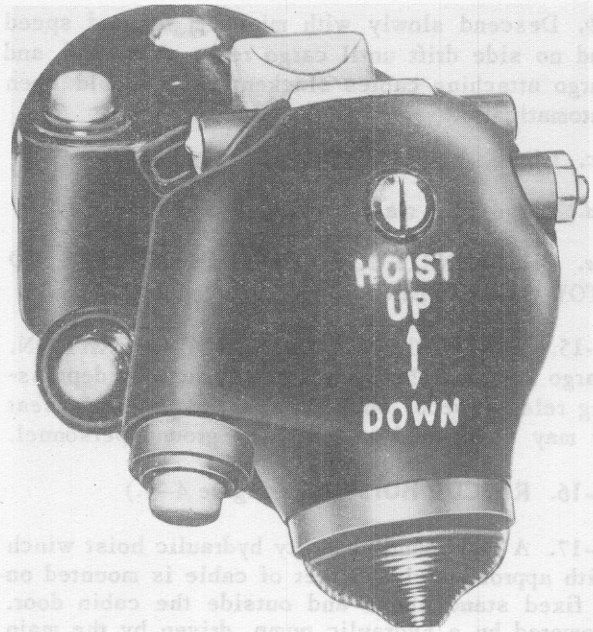


Figure 4–6. Pilot's Hoist Switch

4–24. EMERGENCY HOIST CABLE CUTOFF SWITCHES. (See figures 4–4 and 4–5, and figure 2–20, Chapter 2.)

4–25. Two guarded emergency hoist cable cutoff switches are provided to cut the hoist cable at the winch in case the cable becomes entangled in ground obstructions and cannot be released. The switches are marked EMER CABLE CUT-OFF. One switch is located on the pilots' overhead switch panel (figure 2–20, Chapter 2). To cut the cable, lift the guard and hold the switch in the ON position. The other switch is located on the cabin hoist switch panel. (See figures 4–4 and 4–5.) To cut the cable, lift the guard and hold the switch in the EMER CABLE CUT-OFF position.

4–26. HOIST SHEAR CIRCUIT TEST PANEL. (See figure 4–7.)

4–27. A hoist shear circuit test panel is mounted inside the helicopter above the cabin door. The panel is marked HOIST SHEAR CIRCUIT. The panel contains a guarded switch with positions

Figure 4–7. Hoist Shear Circuit Test Panel

TEST and FIRE. Above the switch is a light, marked TEST. To test the hoist shear circuit system, proceed as follows:

a. Lift guard on hoist shear circuit panel and move switch to TEST position.

b. Actuate pilots' and then crews' hoist emergency cable cutoff switches.

c. Light on hoist shear circuit panel will go on if system is functioning properly.

CAUTION

When testing hoist shear circuit, actuate pilot or crew emergency cable cutoff switch only when test switch is in TEST position

4–28. NORMAL OPERATION.

a. Hoist master switch – PILOT or CREW.

b. Pilot's hoist switch (on cyclic stick grip) or cabin hoist switch – DN, OFF, UP.

Note

When operating hoist from the cabin with cabin door open, secure a safety strap across door opening or use a gunner's type safety belt.

c. When hoist operations are completed, hold either hoist switch in UP position.

CAUTION

Hoist should not be fully raised until oscillations of hoist cable have stopped. This will prevent damage to hoist and anyone or anything on hoist cable at the time.

4–29. EMERGENCY OPERATION.

4–30. If the hoist cable becomes entangled in an obstruction on the ground or the hoist hook cannot be released and the helicopter is endangered, either the pilot or crew may free the helicopter by lifting the guard and activating their respective emergency cable cutoff switch.

4–31. TROOP CARRYING EQUIPMENT.

4–32. TROOP SEATS. (See figures 4–8 and 4–9.)

4–33. Twelve nylon webbed troop seats (figure 4–8), equipped with safety belts, may be installed in the cabin. Five seats are located along the right wall and seven along the left wall, all facing center. The seats may be removed or folded up against the walls of the cabin to provide cargo space, or removed to install litters.

4–34. Eighteen padded troop seats (figure 4–9), equipped with safety belts, may be installed along the cabin walls of the helicopter. Arranged so as to accommodate nine troops on each side facing the center, the seats may be folded up against the walls of the cabin to provide cargo space or removed to install litters. Three of the seats are mounted in front of the cabin door. They are attached to pivot points on the door sill and fold out and down, thus serving as a step when troops are loading and unloading. A lock for this seat-step installation, mounted on the outside of the helicopter, permits the seat to be locked in the DOWN position when it is used as a step. When used as a seat, two retractable pins in the seat frame engage locks mounted on the door frame.

4–35. CASUALTY CARRYING EQUIPMENT.

4–36. LITTERS. (See figure 4–10.)

4–37. Provisions are made in the cabin for the installation of eight aluminum pole-type litters. The litters are installed in two rows, each row being four deep, along the right aft and left forward walls of the cabin. The litters are supported by straps running from the ceiling to the floor on the inboard side and by brackets attached to the helicopter frame on the outboard side. It is recommended that all helicopter crews simulate loading patients so that they will become thoroughly familiar in the operation and minimize confusion on an actual mission.

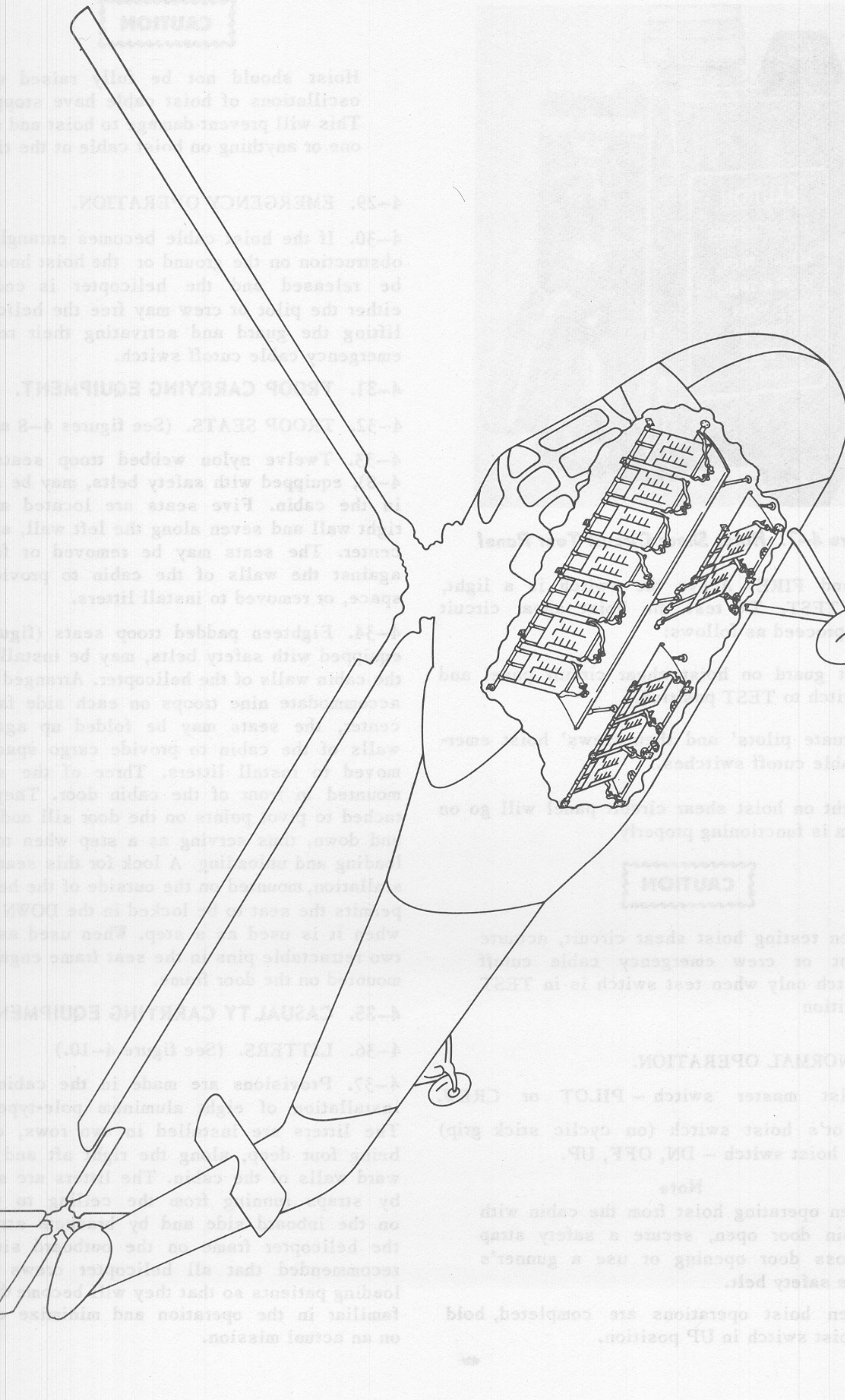


Figure 4-8. 12-Man Troop Seats

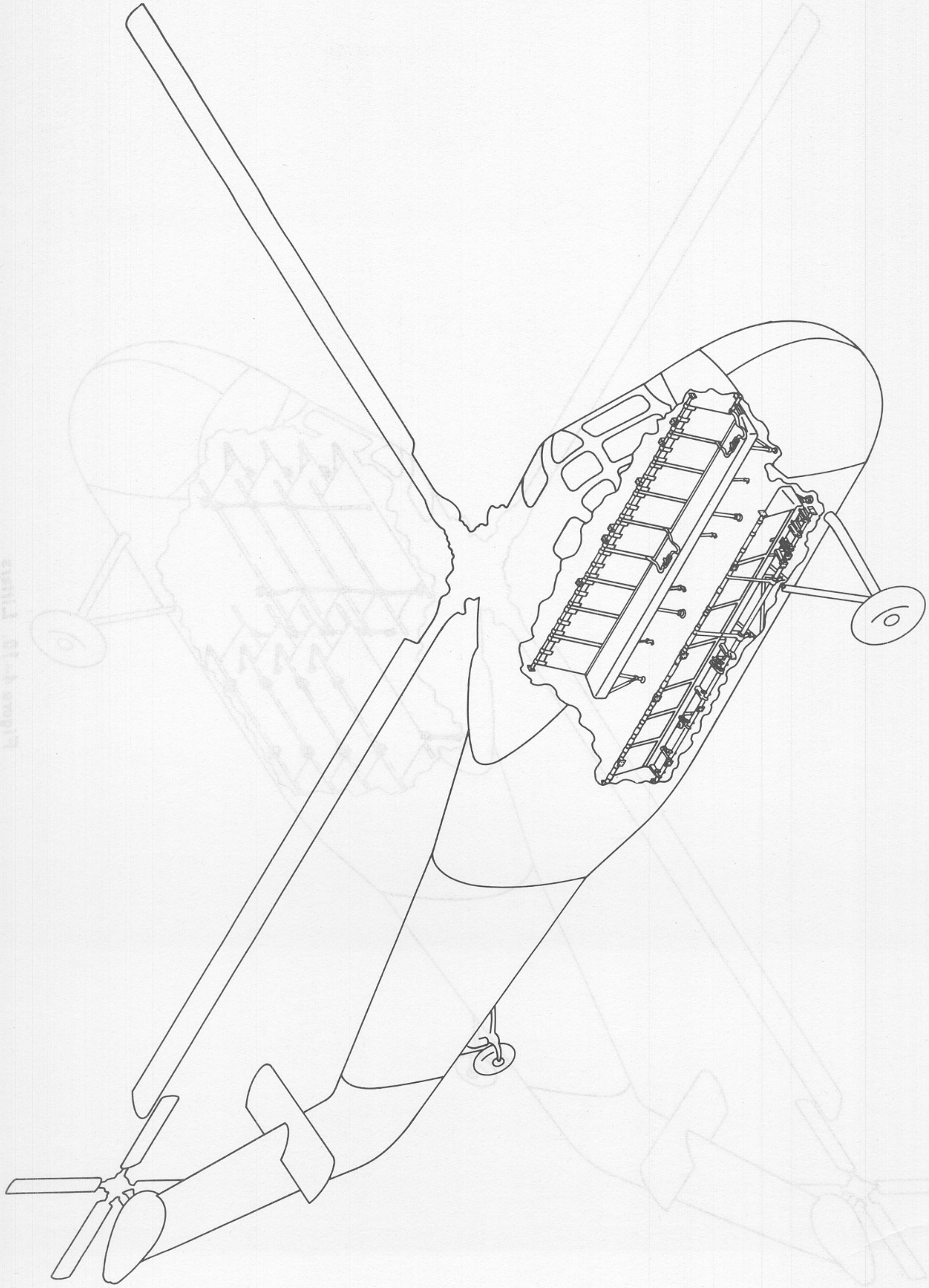


Figure 4–9. 18 Man Troop Seats

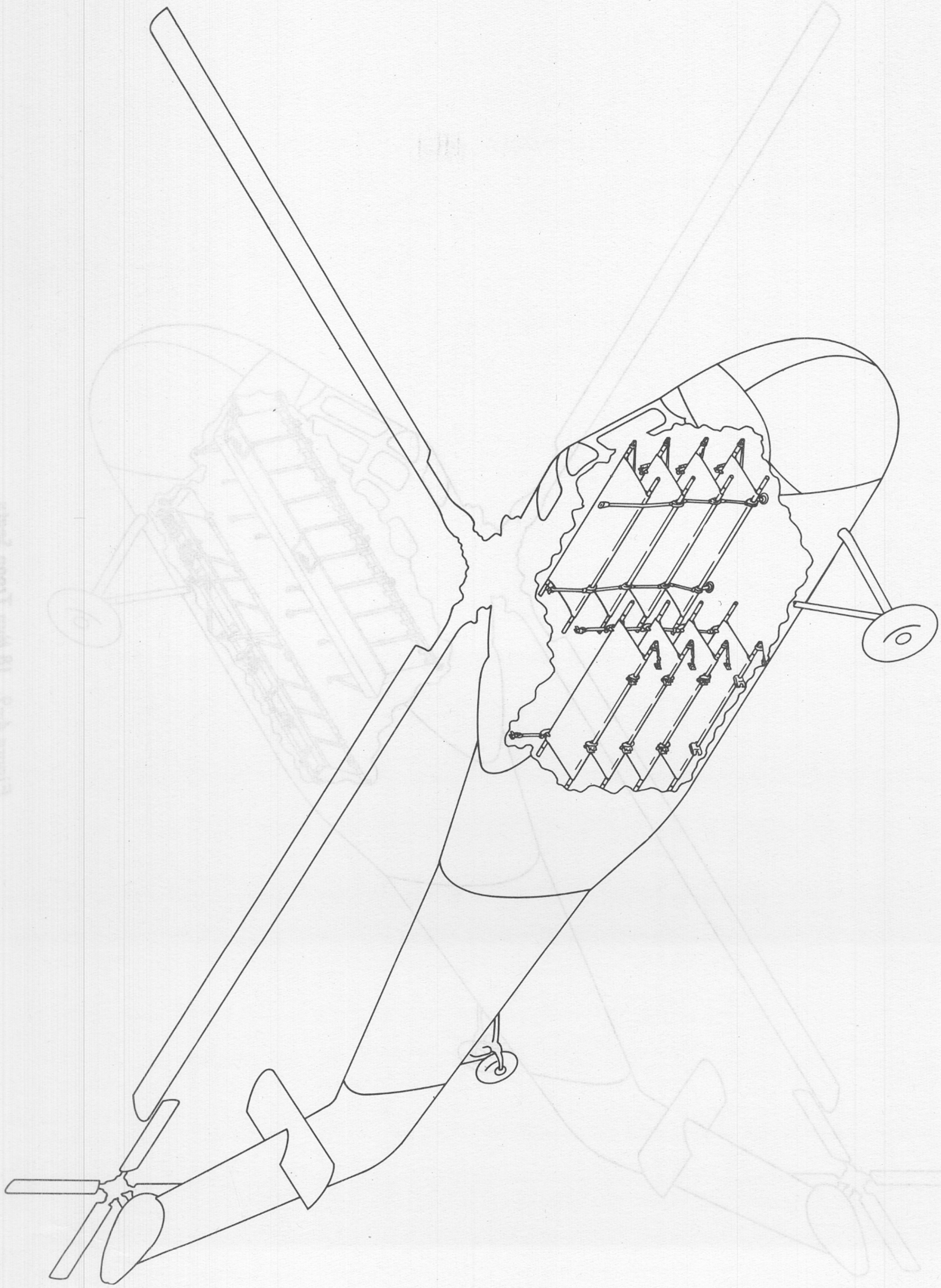


Figure 4–10. Litters

SECTION V
MISCELLANEOUS EQUIPMENT AND MAIN ROTOR BLADE AND PYLON FOLDING

5–1. MISCELLANEOUS EQUIPMENT.

5–2. WINDSHIELD WIPER. (See figure 2–2, Chapter 2.)

5–3. An electrically operated windshield wiper (10) is located on the pilot's windshield. The windshield wiper is controlled by a rotary switch on the overhead switch panel (figure 2–20, Chapter 2), marked WINDSHIELD WIPER. The wiper is driven by a windshield wiper motor (4, figure 2–4, Chapter 2) which operates on direct current from the secondary bus.

5–4. WINDSHIELD WIPER SWITCH. (See figure 2–20, Chapter 2.) The windshield wiper switch is located on the overhead switch panel. The switch has five positions marked SLOW, MED, FAST, OFF, and PARK. Turn the switch momentarily to the PARK position in order to move the wiper blade from the line of vision before turning the switch off.

Note

To prevent scratching windshield, do not operate wiper on dry glass.

5–5. MAP CASE AND FLIGHT REPORT HOLDER. (See figure 2–3, Chapter 2.)

5–6. A map case (4) and flight report holder is located above the pilot's head on the canopy of the pilots' compartment.

5–7. DATA CASE. (See figure 2–3, Chapter 2.)

5–8. An aircraft data case (5) is installed above the copilot's head on the canopy of the pilots' compartment.

5–9. ELECTRONICS COMPARTMENT PERSONNEL BARRIER. (See figures 5–1 and 5–2.)

5–10. An electronics compartment personnel barrier (figure 5–1) closes off the opening in the aft cabin bulkhead to prevent occupants of the cabin from entering the electronics compartment during flight without first obtaining permission from the pilot. The barrier is installed to prevent the possibility of exceeding the aft center of gravity limit. The barrier is locked at the top and slides downward on tracks on either side of the doorway when released. The barrier lock (figure 5–2) can only be released by a switch in the pilots' compartment. The barrier is closed by pulling it up from the floor and inserting the tongue on its upper stiffener into the lock at the top of the doorway.

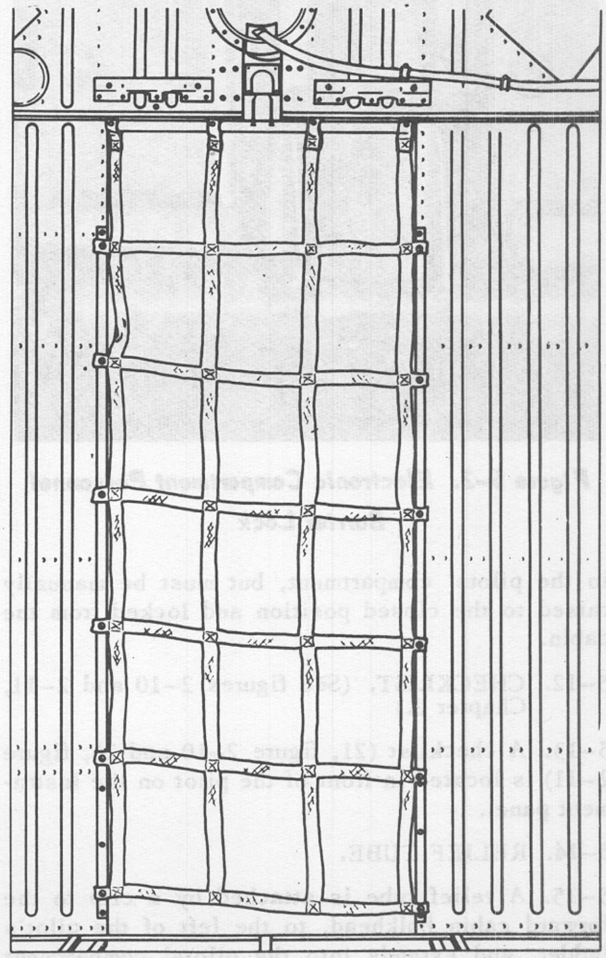


Figure 5–1. Electronics Compartment Personnel Barrier

5–11. ELECTRONICS COMPARTMENT BARRIER RELEASE SWITCH. (See figure 2–20, Chapter 2.) An electronics compartment barrier release switch, located on the overhead switch panel marked ELEC. COMPT. BARRIER, releases the electronics compartment barrier when held in the REL position. The switch operates on dc power from the battery bus. The barrier will slide down the tracks automatically when released by the switch

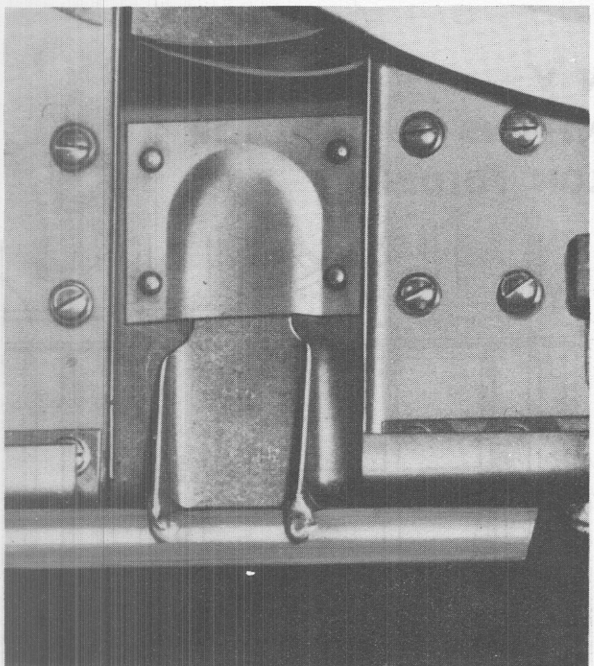


Figure 5–2. Electronic Compartment Personnel Barrier Lock

in the pilots' compartment, but must be manually raised to the closed position and locked from the cabin.

5–12. CHECKLIST. (See figures 2–10 and 2–11, Chapter 2.)

5–13. A checklist (21, figure 2–10 and 25, figure 2–11) is located in front of the pilot on the instrument panel.

5–14. RELIEF TUBE.

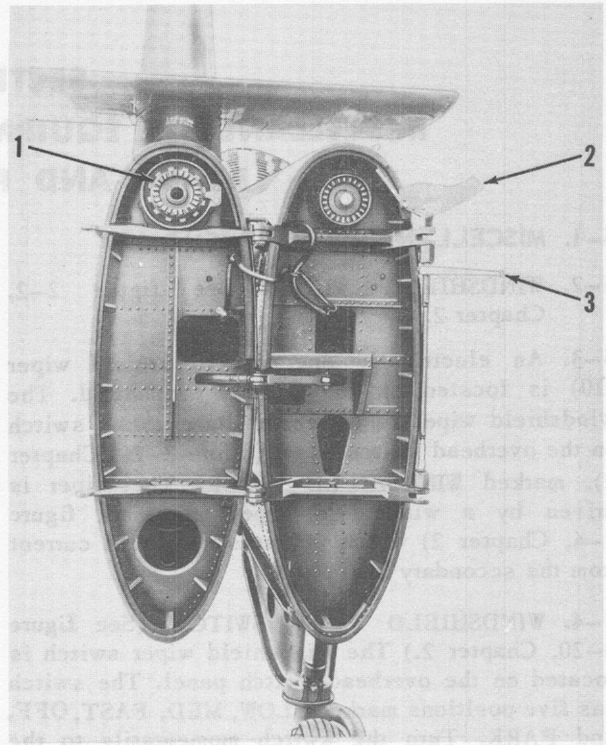
5–15. A relief tube is attached by a clip to the forward cabin bulkhead, to the left of the pilot's ladder, and extends into the pilots' compartment from the cabin.

5–16. MOORING FITTINGS. (See figure 2–2, Chapter 2.)

5–17. Six mooring fittings are provided on the helicopter. Forward mooring fittings (19 and 23) are located on the top and bottom of each main landing gear strut. Aft mooring fittings (27) are located on each side of the tail cone forward of the tail wheel.

5–18. ANTI-GLARE AND BLACK-OUT CURTAINS.

5–19. The fabric anti-glare curtains are provided to cover the openings beneath the pilot's and co-pilot's seats. The curtains are attached with snap fasteners. Four fabric black-out curtains are provided to cover the cabin windows. The curtains



1. Tail Rotor Drive Shaft Disconnect
2. Pylon Lock Pin Position Indicator
3. Pylon Lock Pin Ratchet Handle

Figure 5–3. Pylon Folded

are attached to the window frames with snap fasteners. When not in use, the curtains are folded up and stowed in a pocket between the cabin side panel frames at floor level.

5–20. PYLON AND MAIN ROTOR BLADE FOLDING. (See figure 5–3 and figure 2–3, Chapter 2.)

5–21. The pylon (12, figure 2–3, Chapter 2) may be folded forward and the main rotor blades may be folded back parallel to the fuselage so that the helicopter can be parked in a small area. The pylon is attached to the tail cone at four points just forward of the intermediate gear box. The two left-hand points form pylon hinges (13, figure 2–3, Chapter 2) about which the pylon folds forward against the left side of the tail cone. A pylon folded lock strut (14, figure 2–3, Chapter 2) secured against the tail cone by a spring clip when not in use, holds the pylon in the folded position. A pylon lock (29, figure 2–2, Chapter 2) locks the right side of the pylon to the tail cone. Retractable lockpins are actuated in and out of hinge-like lugs by a pylon lock pin ratchet handle (3, figure 5–3) which is secured against the tail cone when not in

use. Pylon fold handgrips (31, figure 2–2, Chapter 2) are provided for folding the pylon. The tail rotor pedals should be centered before the pylon is folded to assure the minimum of tail rotor pitch change as the pylon is swung forward. The tail rotor should be rotated manually to position the blades at approximately 45 degrees to the horizon in order to provide maximum clearance between the blade tips and the top of the tail cone. A red lockpin position indicator (2, figure 5–3), marked PIN OUT operated mechanically, extends from the right side of the tail cone when the pylon lockpins are not fully seated. The main rotor blades are folded by loosening knurled sleeve locks at each blade spindle on the rotor hub, and rotating the blade until the leading edge is down, then removing the forward blade attaching pin and hinging the blade backward about the aft pin until it lies alongside the fuselage. The blades are secured in the folded position by removable fittings on each side of the tail cone. Since the left-hand blades overlap the pylon in the folded configuration, it is necessary to fold the pylon first if both blades and pylon are to be folded. A fabric boot should be installed over the end of the aft blade on the left-hand side to prevent the blade from chafing against the pylon. The boot is tied to the handgrip above the intermediate gear box and the rubber pad in the boot is secured in position between the pylon and the blade.

CHAPTER 7
OPERATING LIMITATIONS

SECTION I
SCOPE

1-1. GENERAL.

1-2. This chapter covers all important limitations that must be observed during normal flight operations.

1-3. Limitations that are characteristic of specialized phases of operation are not covered in this chapter, but may be found either in Chapter 4, Emergency Procedures, or Chapter 10, Weather Operations.

SECTION II
LIMITATIONS

2–1. INTRODUCTION.

2–2. Operating limitations are established to insure safety of flight and to assist the pilot in obtaining maximum utility from the helicopter. These limitations are derived from flight tests and engineering data; however, they are subject to change as additional operation experience is obtained. Instrument range markings (figure 2–1) should be referred to, as all of the range markings do not necessarily appear in the text. The range markings requiring additional coverage and additional limitations on operating procedures, maneuvers, and weight are covered in the following paragraphs.

2–3. MINIMUM CREW REQUIREMENTS.

2–4. The minimum crew for this helicopter is one pilot. Additional crewmembers, as required, will be added at the discretion of the Commander in accordance with appropriate Department of the Army Regulations.

2–5. ENGINE LIMITATIONS. (See figure 2–1.)

2–6. ALTERNATE FUEL LIMITS.

2–7. When alternate grade fuel is used, maximum manifold pressure is limited to 53.0 inches Hg. For specific values, refer to table 2–III, Chapter 14.

2–8. CARBURETOR AIR TEMPERATURE LIMITS.

2–9. The yellow arc covering the low temperature range of the carburetor air temperature gage indicates that alternate air should be used to prevent carburetor ice when carburetor air temperature is within this range. There is no maximum carburetor air temperature limit imposed for safe engine operation. As long as the maximum allowable limits for engine rpm, cylinder head temperature, and manifold pressure are not exceeded, engine detonation should not occur because of the carburetor air temperature. However, excessive carburetor air temperature will reduce the available engine power. Therefore, to insure maximum available engine power output, do not apply carburetor heat when the carburetor air temperature is above 40°C.

2–10. ENGINE RPM LIMITATIONS. (See figure 2–1.)

2–11. On helicopters serial No. 53-4475 through 54-3022, unless modified in accordance with TM 1-1H-34A-577, the following limitation will apply: During takeoff and landing at high engine rpm speeds, the helicopter is susceptible to dangerous ground resonance. During takeoff and landing, when not utilizing the external cargo sling and as long as the landing gear is in contact with the ground, the maximum recommended engine speed is 2500 rpm. (Refer to table 2–III, Chapter 14.)

2–12. ENGINE OVERSPEED.

2–13. Overspeeding of the engine imposes a severe overload on the engine. When an overspeed condition occurs, the pilot should note the maximum engine rpm attained and the duration of the overspeed condition on DA Form 2408. When an overspeed condition occurs, the following is required:

a. 3000 engine rpm. Check engine for cracked or broken cylinder heads or barrels; remove magnetic sump plugs and removable oil screens and thoroughly inspect for metal particles; drain oil from sump and thoroughly inspect for metal particles.

b. Over 3000 engine rpm. Replace engine.

2–14. TRANSMISSION SYSTEM LIMITATIONS. (See figure 2–1.)

2–15. The oil temperature bulb is located on the oil outlet on the main gear box. Appropriate range markings can be found in figure 2–1.

2–16. GROUND OPERATION-ROTOR DISENGAGED.

2–17. Avoid prolonged ground operation above 1400 rpm with clutch disengaged, to prevent overheating of the clutch. Overheating will result in leakage and subsequent damage to the clutch. In event 1400 rpm must be exceeded with clutch disengaged, engine operation should be held between 1400 rpm and 1700 rpm for a period of not more than 10 minutes.

CAUTION

Do not exceed 1700 rpm with clutch disengaged

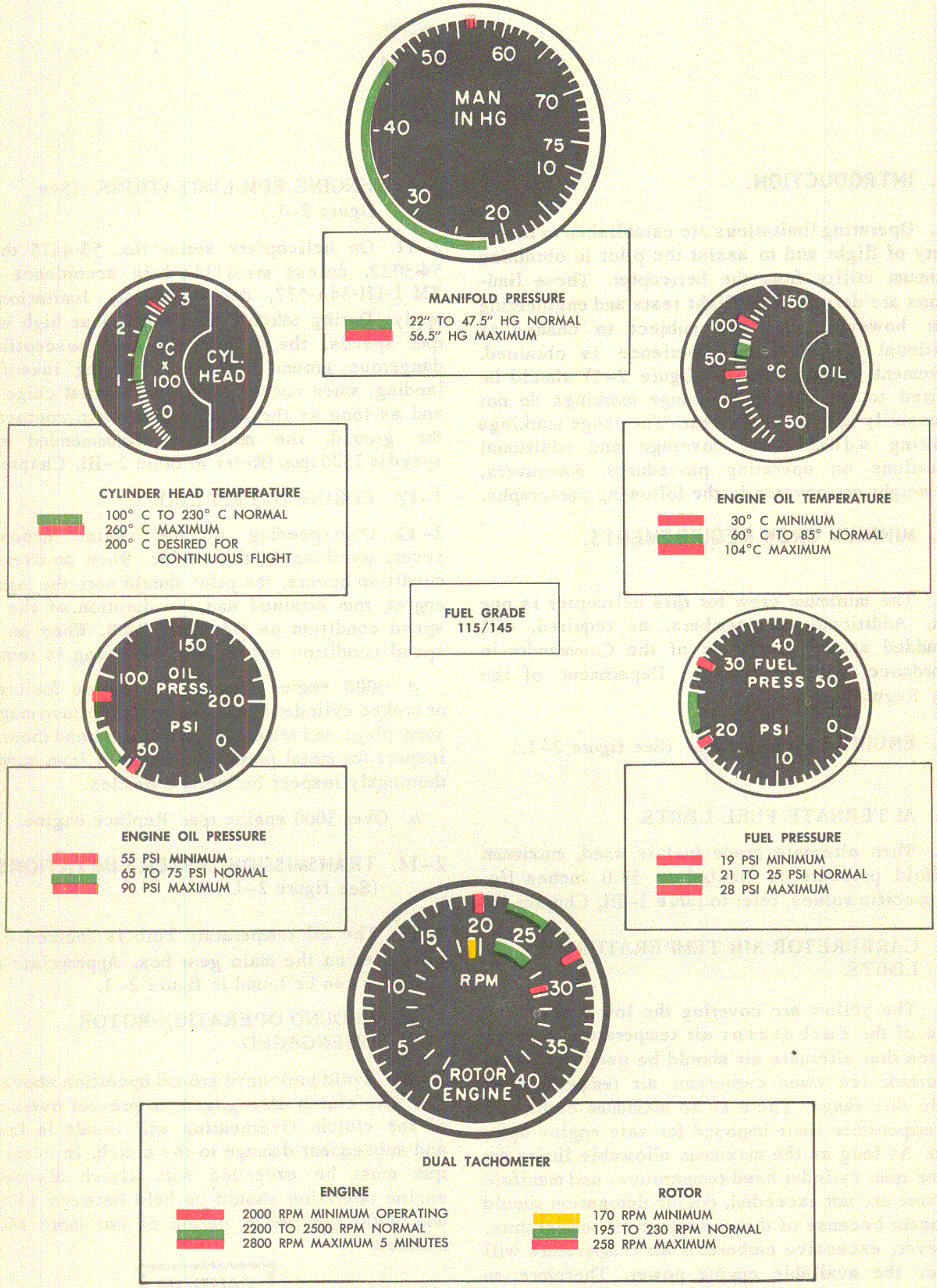
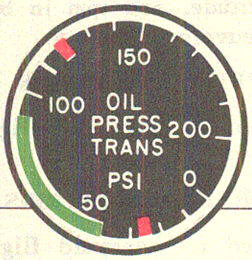
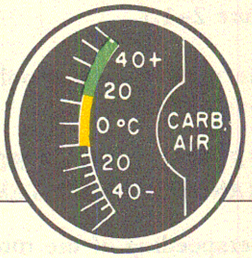


Figure 2–1. Instrument Range Markings (Sheet 1 of 2)



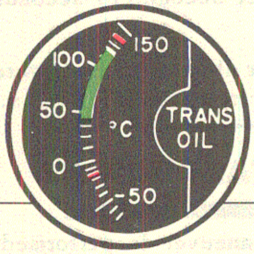
TRANSMISSION OIL PRESSURE

25 PSI MINIMUM
40 TO 90 PSI NORMAL
120 PSI MAXIMUM



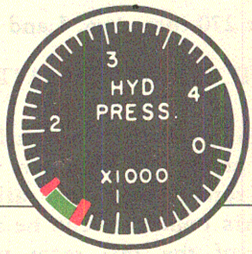
CARBURETOR AIR TEMPERATURE

—10° C TO 15° C CAUTION
15° C TO 40° C NORMAL
40° C MAXIMUM USING CARBURETOR HEAT



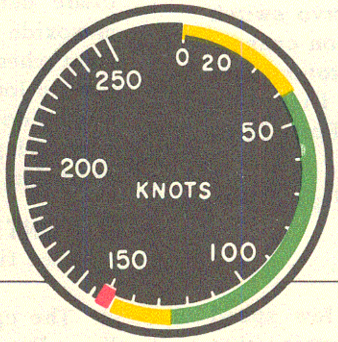
TRANSMISSION OIL TEMPERATURE

—15° C MINIMUM
40° C TO 120° C NORMAL
140° C MAXIMUM



HYDRAULIC PRESSURE PRIMARY AND AUXILIARY SERVO

1300 PSI MINIMUM
1300 TO 1600 PSI NORMAL
1600 PSI MAXIMUM



AIRSPEED INDICATOR

0 TO 40 KNOTS CAUTION (10 TO 450 FT ALTITUDE)
40 TO 128 KNOTS DESIRED
128 TO 150 KNOTS POSSIBLE BLADE STALL
150 KNOTS MAXIMUM

Figure 2–1. Instrument Range Markings (Sheet 2 of 2)

2-18. ROTOR SYSTEM LIMITATIONS. (See figure 2-1.)

2-19. The rotor system should not be engaged in winds above 45 knots.

2-20. OVERSPEEDING OF ROTOR AND TRANSMISSION SYSTEM.

2-21. Overspeeding of the rotor system imposes a severe overload on the rotor and transmission system. When an overspeed condition occurs, the pilot should note the maximum rotor rpm attained and the duration of the overspeed condition on DA Form 2408. When an overspeed condition occurs, the following is required:

a. 258-270 rotor rpm range. Land at first practical landing site. A thorough visual inspection should be conducted by organizational maintenance personnel prior to further flight.

b. Over 270 rotor rpm. Land immediately

2-22. TAIL ROTOR LIMITATIONS.

2-23. Rapid reversal of tail rotor controls is prohibited as it may induce a vibratory instability of the tail rotor, pylon, and tail rotor flight control system. This condition can be identified by severe vibrations of the tail rotor pedals and is more likely to be encountered during rapid reversal of the tail rotor controls in hovering flight. If vibratory instability of the tail rotor system is encountered during flight, momentarily place the servo switch from ON to AUX. OFF position. This action will terminate the instability. Return the servo switch to ON position immediately after vibration ceases. When vibratory instability of the tail rotor flight control system is encountered during flight, the pilot must note such vibration on DA Form 2408.

2-24. AIRSPEED LIMITATIONS. (See figure 2-1 and chart 2-I.)

2-25. FORWARD SPEED LIMITATIONS.

2-26. The yellow arc covering the low speed range of the airspeed indicator is a warning that in event of engine failure at low altitude with 0 to 30 knots airspeed, the possibility of accomplishing a satisfactory landing is reduced.

2-27. The yellow arc covering the high speed range of the airspeed indicator is a warning that rotor speed should be controlled to prevent retreating blade stall at low rotor rpm or compressibility effect on the advancing blade at high rpm. Chart 3-I, Chapter 8, illustrates the airspeeds at which blade stall will occur with various conditions of gross weight, altitude, and rpm in both level flight and during maneuvers.

2-28. SIDEWARD SPEED LIMITATIONS.

2-29. Maximum speed for sideward flight is 45 knots.

2-30. REARWARD SPEED LIMITATIONS.

2-31. Maximum speed for rearward flight is 20 knots.

2-32. PROHIBITED MANEUVERS.

2-33. All maneuvers are limited to 80 percent of limit load. The helicopter is restricted to normal flying, and acrobatics are prohibited.

2-34. HOVERING LIMITATIONS.

2-35. Turns, while hovering, should not exceed a rate of 24 degrees per second (15 seconds for 360 degrees).

2-36. The helicopter should not be hovered crosswind when wind velocity exceeds 45 knots.

WARNING

When hovering maneuver is performed for a time period greater than 5 minutes, carbon monoxide toxicant can penetrate pilots' compartment to a dangerous degree of concentration if pilots' compartment windows and cabin door are open. To preclude dangerous concentration of carbon monoxide penetration into pilots' compartment when hovering for 5 minutes or more, the pilots' compartment windows and cargo door shall be closed; also, the ventilating system shall be placed in operation.

2-37. CENTER-OF-GRAVITY LIMITATIONS. (See figure 2-2.)

2-38. The cg limits can be exceeded by improper loading. Proper loading should be determined by use of Chapter 12. It is also possible to exceed cg limits by improper fuel management. (Refer to paragraph 2-24, Chapter 9.)

2-39. WEIGHT LIMITATIONS.

2-40. The design gross weight of the helicopter is 12,068 pounds at a limit load factor of 2.63.

2-41. The maximum alternate gross weight and the maximum recommended takeoff weight is 13,600

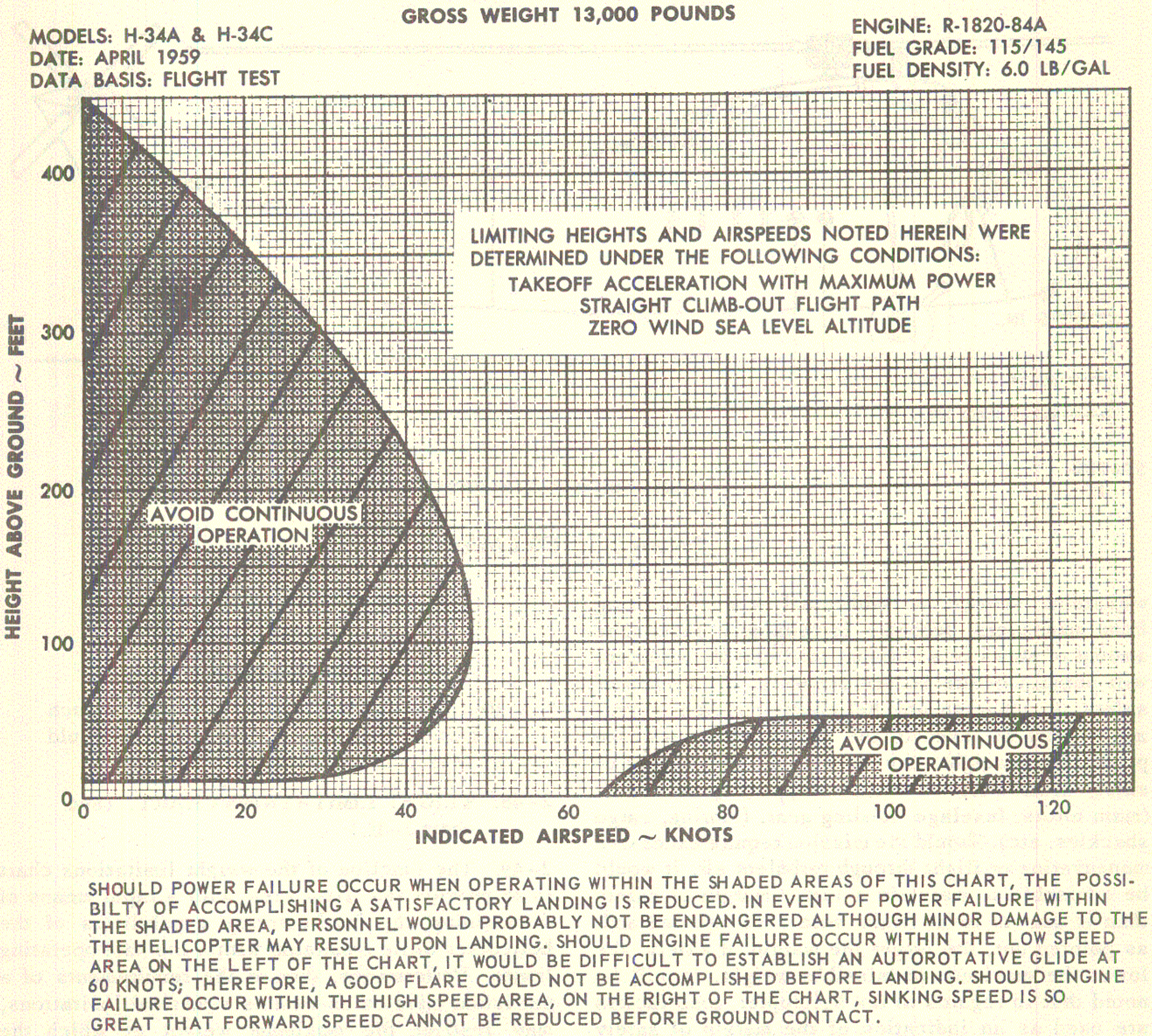


Chart 2-1. Minimum Height and Distance for Safe Landing After Engine Failure

pounds at a limit load factor of 2.33. In addition to the gross weights, other criteria covered in the following paragraphs will also limit maximum weights.

CAUTION

On helicopters serial No. 53-4475 through 54-3022, unless modified in accordance with TM1-1H-34A-577, the following limitation will apply: For takeoff and landing, when not utilizing external cargo sling, maximum recommended gross weight is 12,000 pounds.

2–42. INTERNAL CARGO.

2–43. The cabin of the helicopter is approximately 13 feet 5 inches long, 5 feet 10 inches high, and 5 feet wide, with a volumetric capacity of approximately 350 cubic feet. The cabin floor is stressed for 200 pounds-per-square foot.

2–44. EXTERNAL CARGO.

2–45. Maximum load for the external cargo sling is 5000 pounds.

2–46. MARGIN OF SAFETY AND LIMIT LOAD FACTORS.

2–47. It is readily understandable that as a structure is loaded to higher weights, its ability to

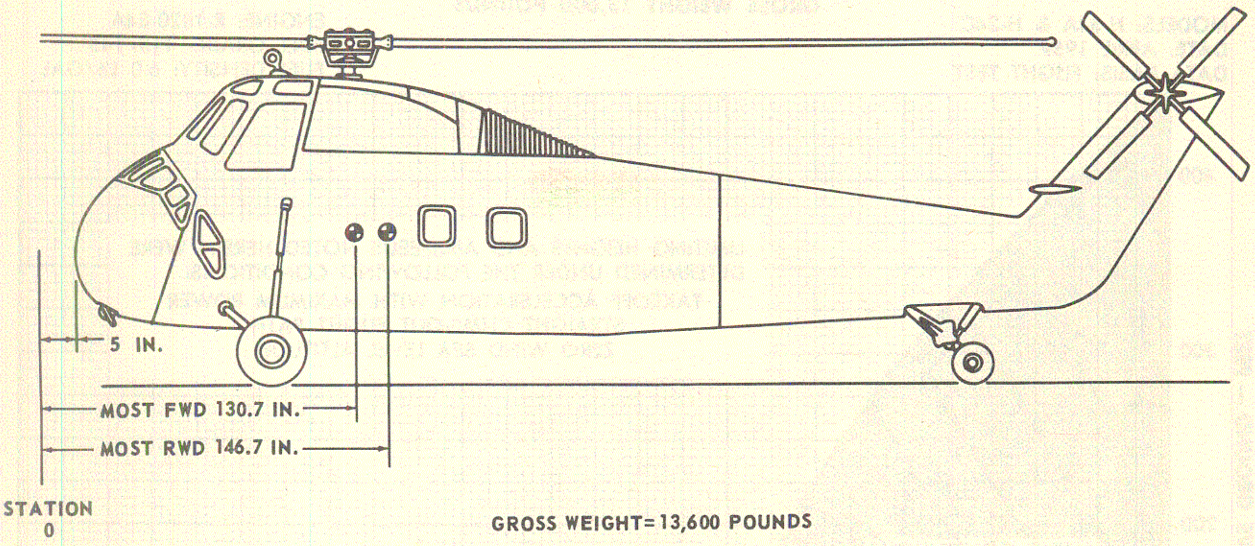


Figure 2-2. CG Limits

withstand shocks or additional loads resulting from maneuvers becomes increasingly less. The amount of shock or additional load that the structure will sustain before failure occurs is the margin of safety. In planning any helicopter mission, cognizance must be taken of the fact that the maximum permissible weight may depend on the margin of safety desired for the various supporting structures (main rotors, fuselage, landing gear, flooring, cargo shackles, etc). Should the mission require excessive maneuvering or flight through turbulent air, it would be advisable to maintain a larger margin of safety than if smooth level flight were contemplated and, as pointed out, the larger the margin of safety, the lower the maximum permissible weight. It will be noted that in regards to the helicopter, load factors are used as an indication of the margin of safety that is available. At any particular moment of operation, the structural margin of safety, for example, will be equal to the difference between the limit factor the helicopter is designed for and the flight load factor the helicopter is sustaining at that moment, due to increases in gross weight, maneuvers, or turbulence. For example, should the helicopter be loaded so that it is capable of making good a limit load factor of 2.63, and during various phases of the flight, flight load factors of 1.5, 2.0, and 1.0 are imposed on the helicopter, the margins of safety during these phases would be 1.13, 0.63, and 1.63 load factors, respectively. It is, therefore, of prime importance to anticipate the maximum flight load factors that will be encountered during a mission in order that the helicopter will be loaded in such a fashion that the load factors it was designed for will never be exceeded during any part of the flight.

WARNING

Helicopter should never be loaded in such a manner that its limit load factor would be less than 2.0.

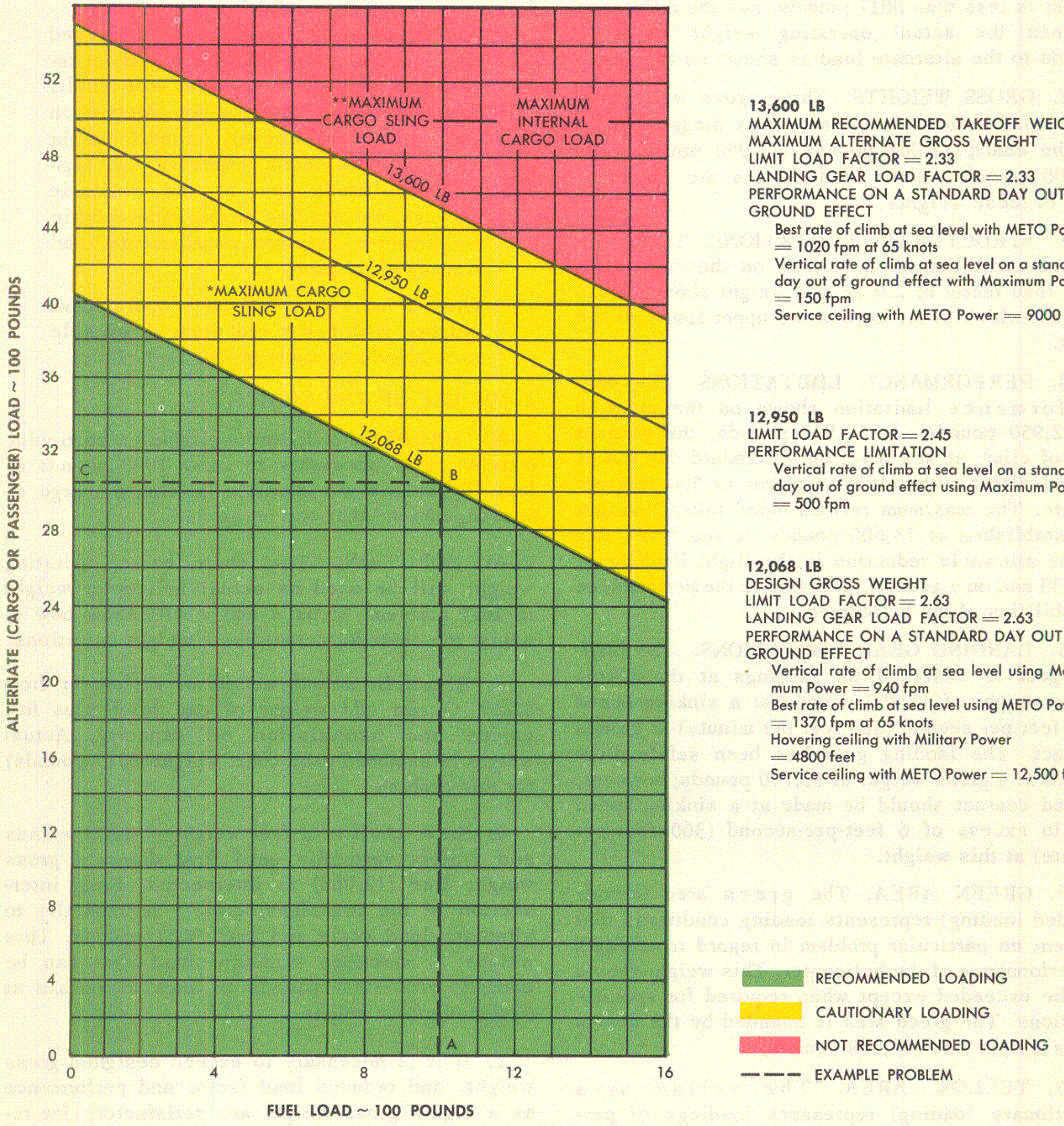
2-48. WEIGHT LIMITATIONS CHART. (See chart 2-II.)

2-49. The function of the weight limitations chart is to provide the flight crew with a rapid means of determining the load-carrying capabilities of the helicopter while remaining within the safe operating limits. Performance, due to the requirements of a particular mission as well as structural limitations, may restrict the maximum weight at which the helicopter can be flown.

2-50. EXPLANATION OF THE CHART. The following paragraphs will explain the construction and use of the weight limitations chart.

2-51. OPERATING WEIGHT. The operating weight on which the chart is based is 8017 pounds. The operating weight is the weight of the helicopter ready to fly except for the two variables, alternate load (cargo or passengers) and fuel, and is the approximate basic helicopter weight shown on Chart C plus the weight of one pilot, full oil capacity, and trapped fuel. The intersection of the alternate load and the fuel load axis at zero represent this operating weight. The chart indicates the various combinations of fuel and alternate loads that can be added to the operating weight to remain within the safe operating range. Since the actual weights of individual helicopters vary, it will be

OPERATING WEIGHT = 8017 POUNDS



13,600 LB
MAXIMUM RECOMMENDED TAKEOFF WEIGHT
MAXIMUM ALTERNATE GROSS WEIGHT
LIMIT LOAD FACTOR = 2.33
LANDING GEAR LOAD FACTOR = 2.33
PERFORMANCE ON A STANDARD DAY OUT OF GROUND EFFECT
- Best rate of climb at sea level with METO Power = 1020 fpm at 65 knots
- Vertical rate of climb at sea level on a standard day out of ground effect with Maximum Power = 150 fpm
- Service ceiling with METO Power = 9000 feet

12,950 LB
LIMIT LOAD FACTOR = 2.45
PERFORMANCE LIMITATION
- Vertical rate of climb at sea level on a standard day out of ground effect using Maximum Power = 500 fpm

12,068 LB
DESIGN GROSS WEIGHT
LIMIT LOAD FACTOR = 2.63
LANDING GEAR LOAD FACTOR = 2.63
PERFORMANCE ON A STANDARD DAY OUT OF GROUND EFFECT
- Vertical rate of climb at sea level using Maximum Power = 940 fpm
- Best rate of climb at sea level using METO Power = 1370 fpm at 65 knots
- Hovering ceiling with Military Power = 4800 feet
- Service ceiling with METO Power = 12,500 feet

*4000 LB SLING — HELICOPTER SERIAL No. 53-4475 THROUGH 55-4504

**5000 LB SLING — HELICOPTER SERIAL No. 56-4284 AND SUBSEQUENT

Chart 2–II. Weight Limitations

necessary to adjust the chart to these individual weights. To adjust the chart, determine the basic weight of the helicopter from Chart C, add 200 pounds for the pilot, and 90 pounds for full oil capacity. If the actual operating weight exceeds 8017 pounds, subtract the difference between the actual operating weight and 8017 pounds from the alternate load as shown on the chart. If the actual operating weight is less than 8017 pounds, add the difference between the actual operating weight and 8017 pounds to the alternate load as shown on the chart.

2–52. GROSS WEIGHTS. Three gross weights of the loaded helicopter are shown as diagonal lines on the chart; 12,068 pounds, 12,950 pounds, and 13,600 pounds. Limit load factors are shown at each of these weights.

2–53. STRUCTURAL LIMITATIONS. There are no structural limitations shown on the chart. The limit load factor of 2.0 is at a weight above 16,000 pounds, which is far beyond the upper limits of the chart.

2–54. PERFORMANCE LIMITATIONS. The only performance limitation shown on the chart is at 12,950 pounds. At 12,950 pounds, the vertical rate of climb at sea level on a standard day out of ground effect with maximum power is 500 feet per minute. The maximum recommended takeoff weight is established at 13,600 pounds at sea level, due to the allowable reduction in the flight load factor to 2.33 and on a general reduction in the performance capabilities of the helicopter.

2–55. LANDING GEAR LIMITATIONS. The landing gear is designed for landings at the design gross weight of 11,867 pounds at a sinking speed of 8 feet per second (480 feet per minute) at ground contact. The landing gear has been safely drop-tested at a gross weight of 12,750 pounds; however, ground contact should be made at a sinking speed not in excess of 6 feet-per-second (360 feet per minute) at this weight.

2–56. GREEN AREA. The green area (recommended loading) represents loading conditions that present no particular problem in regard to strength or performance of the helicopter. This weight should not be exceeded except when required for specific missions. The green area is bounded by the design gross weight line (12,068 pounds).

2–57. YELLOW AREA. The yellow area (cautionary loading) represents loadings of progressively increasing risk as the red area is approached. Care must be exercised when operating within this area as performance and flight load factors decrease. This area is bounded by the maximum alternate gross weight (13,600 pounds).

2–58. RED AREA. The red area of the chart (prohibited loading) represents loadings that should not be used except under conditions of extreme emergency when safety of flight is of secondary importance. The Commander will decide whether the degree of risk warrants use of the helicopter at weights within the red area.

Note

Operating weight should never exceed that required for mission since unnecessary risk and equipment wear will result. Date shown on chart is for information and guidance; however, takeoff weight must be considered, especially at high ground altitude, as to the available runways, surrounding terrain, atmospheric temperatures, mission requirements, and urgency of mission.

When a helicopter has been operated at weights within the red area, a suitable entry should be made on DA Form 2408.

2–59. USE OF THE CHART.

2–60. PROBLEM 1. In accomplishing a particular mission it is necessary to carry 1000 pounds of fuel. Determine the maximum alternate (cargo or passenger) load that can be carried.

2–61. SOLUTION. The chart basic operating weight will be used as actual helicopter weight in this problem. Steps *d* and *e* will show how to adjust the chart for actual basic weight variations.

a. Establish actual weight of helicopter from Chart C and add weight of one pilot plus full engine and transmission oil capacity. Actual weight is assumed to be chart weight (8017 pounds) for this problem.

b. Enter chart at a fuel weight of 1000 pounds and project vertically until first diagonal gross weight line (12,068) is intersected. From intersection of the two lines, project horizontally to alternate load scale and read 3051 pounds. This weight is maximum alternate load that can be carried with 1000 pounds of fuel to remain at designed gross weight.

c. If it is necessary to exceed designed gross weight, and reduced load factor and performance at a higher gross weight are satisfactory for requirements of particular mission, enter chart and project vertically from 1000-pound fuel line until second diagonal gross weight line (12,950 pounds) is intersected. From this intersection, project horizontally to alternate load scale and read 3933 pounds.

d. If actual helicopter weight is 8067 pounds, instead of 8017 pounds, chart must be adjusted by reducing alternate load. Therefore, for operation at design gross weight of 12,068 pounds, maximum alternate load would be the load shown on chart (3051 pounds) minus 50 pounds or 3001 pounds. Following this same procedure, maximum alternate load at 12,950 pounds is 3933 pounds -50 pounds = 3883 pounds.

e. If actual helicopter weight is 7967 pounds, chart may be adjusted by adding to alternate load. For operation at design gross weight, maximum alternate load would be 3051 pounds +50 pounds = 3101 pounds and for operation at 12,950 pounds, maximum alternate load would be 3933 pounds +50 pounds = 3983 pounds.

f. If it is necessary to exceed 12,950 pounds gross weight and performance limitation of 150 feet per minute vertical rate of climb at 13,600 pounds, and reduction in load factor and performance is satisfactory for particular mission being flown, enter chart and project vertically from 1000-pound fuel line until 13,600-pound line is intersected. Alternate load at this weight is 4583 pounds.

CHAPTER 8
FLIGHT CHARACTERISTICS

SECTION I
SCOPE

1-1. GENERAL.

1-2. This chapter informs the operator of any unique flight characteristics of the helicopter. The information contained in this chapter is based on flight operations at maximum gross weight.

SECTION II

MANEUVERS

2-1. MANEUVERING FLIGHT.

2-2. No acrobatic maneuvers are permitted with this helicopter. The unlimited freedom of movement at low speed and normal fuselage attitude, including the ability to take off and land vertically and to hover over one spot are the chief advantages of the helicopter.

SECTION III

CONTROL CHARACTERISTICS

3–1. GENERAL.

3–2. Helicopter flight is dependent upon rotor speed and pitch of the rotor blades. The amount of power developed by the engine and transmitted to the rotor system, the control of rotor speed, and the pitch variations of the blades are the main factors that determine the flight characteristics of a helicopter. During flight, the blades are turning at a relatively high speed and creating a relative wind regardless of the forward motion of the helicopter. Since lift is developed by the rotating blades and controlled by varying the pitch of the blades, the helicopter is not limited to stall characteristics of a fixed wing aircraft, but is able to hover or move in any direction at a controlled low airspeed and remain safely airborne. The dual tachometer and the manifold pressure gage, in addition to being engine instruments, are important flight instruments as sufficient power must be developed by the engine to provide the rotor speed and blade angles necessary for lift and controllability throughout the wide airspeed range of helicopter operations.

3–3. RANGE OF AIRSPEED.

3–4. The normal speed range in level flight at sea level extends from a forward speed of 128 knots to a rearward speed of 20 knots and includes lateral speed of 45 knots in either direction. While there may be no need of rearward or sideward flight at their maximum values while maneuvering, under certain conditions it may be necessary to hover in tailwinds or crosswinds of the same velocities mentioned above for rearward or sideward flight. The helicopter is directionally stable in forward flight, but in rearward or sideward flight the nose of the helicopter has a tendency to swing in the direction of flight. This is due to the center of effective fin area which is aft of the main rotor. Forward safe operating airspeeds are limited by the power available, blade stall of the retreating blade, or by the effect of compressibility on the advancing blade. The following paragraphs present a brief discussion of each.

3–5. POWER REQUIRED FOR HOVERING.

3–6. To remain airborne, a certain mass of air must be displaced in a downward direction to overcome the force of gravity. In hovering flight, this mass of air is drawn from directly above the main rotor and is forced downward through the main rotor. This is accomplished solely by the direct action of the main rotor. Considerable power is necessary to displace the required amount of air as well as to overcome the air friction developed by the large rotor blades.

3–7. POWER REQUIRED AT MEDIUM AIRSPEEDS.

3–8. In forward flight, the mass of air flows through the main rotor at a higher velocity and reduces the need for direct rotor action. This increase in velocity is primarily due to the forward motion of the helicopter. Less power is required to displace the required mass of air, although approximately the same power is required to overcome air friction of the blades. Air friction on the fuselage and other components of the helicopter, developed in forward flight, requires some additional power. At moderate airspeeds (50 to 80 knots), the reduction in power required to displace the mass of air is far greater than the small increase in power required to overcome air friction. This range of airspeed, therefore, will require the least amount of power for level flight. Correspondingly, this speed range offers the greatest excess of power available for climbing or the minimum rate of descent in autorotation.

3–9. POWER REQUIRED AT HIGH AIRSPEEDS.

3–10. As airspeed increases above the medium speed range, power required for lift decreases, but power to overcome friction increases rapidly. Maximum speed in level flight is, therefore, limited mainly by drag unless blade stall or compressibility effects are encountered at lower airspeeds.

3–11. BLADE STALL.

3–12. During accelerated flight conditions, or when operating with high values of forward speed, gross weight, power, or altitude, or with low rotor rpm, a stall may occur at the outer portion of the retreating blade. The rearward speed of the retreating blade is partially cancelled by the forward airspeed of the helicopter resulting in a low relative wind velocity. When the relative wind velocity of the retreating blade drops below a certain value, or when the angle of attack of the retreating blade exceeds a certain value, blade stall will be experienced. Blade stall is indicated

by roughness of the main rotor which is transmitted to the fuselage. Blade stall in straight and level flight does not present any undue hazards as the roughness in the helicopter provides ample warning. When this roughness occurs, further increases in forward speed or a reduction in rpm can aggravate blade stall to the point where a reduction in performance and controllability will be experienced. During maneuvers that increase the G load, such as sharp turns or high speed flares from diving descents where rapid application of collective pitch is involved, especially when using aft cyclic control, severe blade stall may be encountered. Severe blade stall may also be encountered in turbulence with rapid or sharp forward application of cyclic control and during normal turn recoveries at high altitude when forward cyclic control is applied to lower the nose of the helicopter. Severe blade stall can be recognized by an abrupt pitch up of the nose of the helicopter. The pitch up is caused by the retreating blade having a greater area than the stalled area encountered during the fringe of the blade stall and is due to excessive angle of attack. This greater stalled area results in a loss of lift of the retreating blade, which causes the blade to drop downward instead of climbing upward as it approaches the tail cone of the helicopter. The retreating blade will reach its lowest point 90 degrees from the point at which lift decreases, thereby causing the tip-path plane of rotation of the main rotor blades to tilt downward toward the rear, which, in turn, causes the nose of the helicopter to pitch upward. This change in attitude results in an extremely high G loading and an increased inflow of air to the rotor which greatly increases the angle of attack and accentuates blade stall. The normal control response to overcome pitching (forward application of cyclic control without decreasing collective pitch) may be ineffective. The controlled pitch up will last only for a very short period as full control is restored automatically as airspeed decreases in the nose-high attitude and the excessively high angle of attack no longer exists. Chart 3–I may be used to determine the airspeed at which blade stall will occur at various conditions of gross weight, altitude, and rpm during coordinated turns in level flight, or during maneuvers or gusts that increase the G load.

3–13. BLADE STALL CHART. (See chart 3–I.)

3–14. The function of the blade stall chart is to provide the pilot and copilot with a rapid means of determining blade stall for various conditions of gross weight, rpm, and load factor at given altitudes, indicated airspeeds, angles of bank, or maneuver load factors. The corrected stalling speed is found by determining the level flight stalling speed and subtracting the speed correction for angle of bank or maneuver load factors.

3–15. USE OF THE CHART.

3–16. EXAMPLE 1. Determine the level flight stalling speed at a gross weight of 12,000 pounds at a density altitude of 4000 feet, using 2400 rpm.

a. Enter the chart at 4000 feet (point A).

b. From point A, move horizontally to the 12,000-pound gross weight line (point B).

c. From point B, proceed downward to the 2500-rpm base line (point C).

d. From point C, move parallel to the rpm influence line to 2400 rpm (point D).

e. From point D, read vertically to obtain the stalling speed (point E). At the conditions set forth, the stalling speed would be 96 knots.

3–17. EXAMPLE 2. Determine the speed correction in a coordinated turn requiring an angle of bank of 30 degrees with same gross weight, altitude, and rpm conditions as in example 1.

a. Enter chart at an angle of bank of 30 degrees (point F).

b. From point F, move horizontally to load factor line (point G).

c. From point G, move vertically to 4000-foot speed correction line (point H).

d. From point H, move horizontally to speed correction reading (point I) and read -12 knots.

e. To obtain stalling speed during 30-degree bank, apply speed correction of -12 knots (point I) to stalling speed in level flight of 96 knots (point E). Airspeed at which blade stall occurs in a coordinated turn requiring a 30-degree bank with above conditions is 96 -12 = 84 knots.

3–18. EXAMPLE 3. Determine the airspeed at which blade stall will occur during a maneuver in which 1.3 G's is pulled with the same gross weight, altitude, and rpm conditions as in example 1.

a. Enter chart at a load factor of 1.3 G's (point J).

b. From point J, move vertically to 4000-foot speed correction line (point K).

c. From point K, move horizontally to speed correction reading (point L). Speed correction is found to be -26 knots.

d. To obtain the stalling speed during 1.3 G's maneuver, apply speed correction -26 knots (point

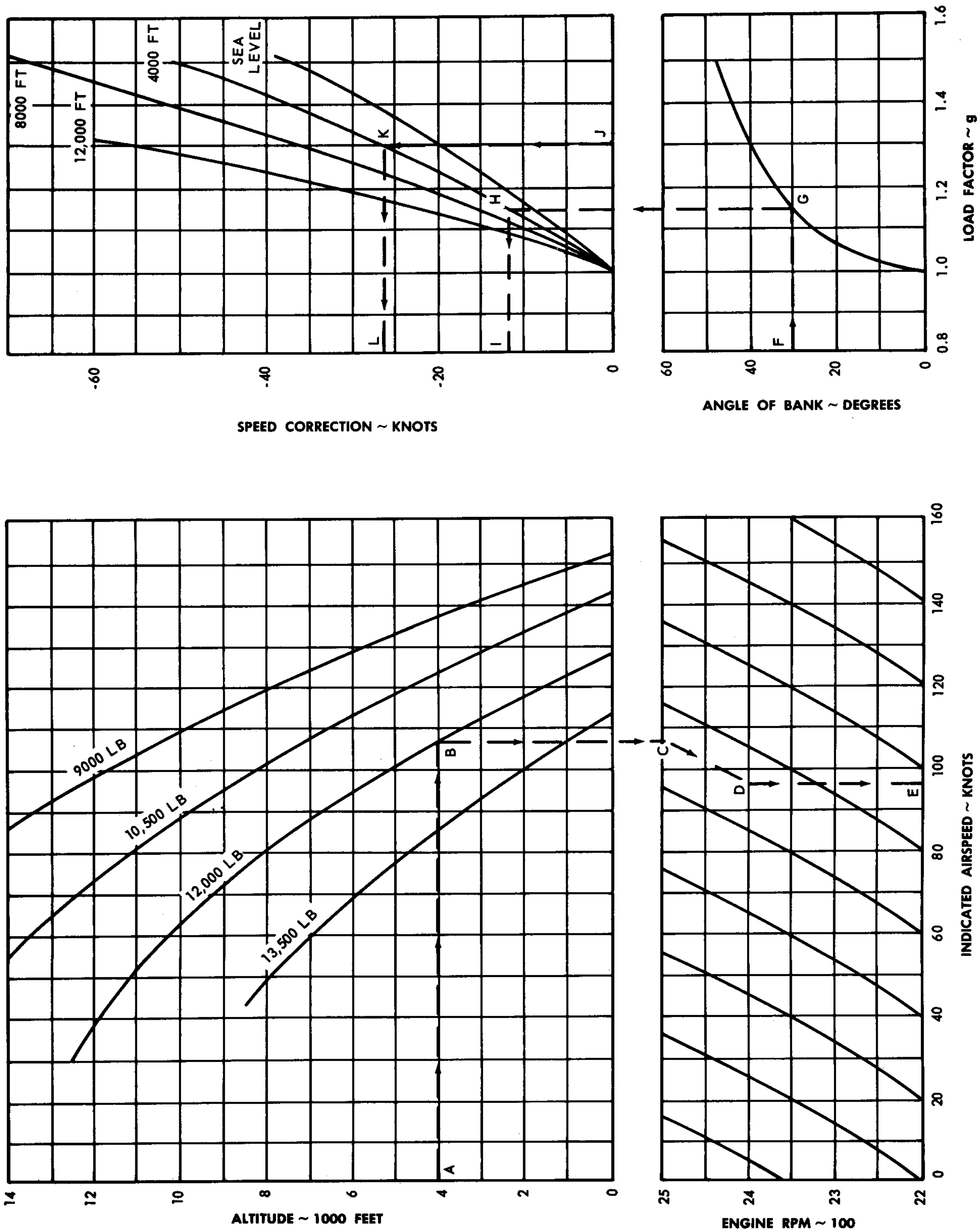


Chart 3-1. Blade Stall

L) to stalling speed in level flight, 96 knots (point E). Indicated stalling speed in a 1.3 G's maneuver would be 96 -26 = 70 knots.

3–19. COMPRESSIBILITY EFFECT.

3–20. Compressibility may be encountered when operating at high forward airspeed, high rotor rpm, or low temperatures. Compressibility first occurs on the outer portion of the advancing blade on the right side of the helicopter. The forward speed of the advancing blade and the forward speed of the helicopter combine to produce an extremely high velocity approaching the critical Mach Number of the blades. Compressibility is indicated by roughness of the main rotor blades which is transmitted to the fuselage. The critical Mach Number of 0.8 is an arbitrary value based on theoretical analysis of wind tunnel data. Flight in this region should be approached with extreme caution. When roughness due to compressibility is encountered, an increase in forward speed or an increase in rpm can aggravate the compressibility effect to the point where a reduction in performance and controllability will be experienced. Table 3–I indicates the relationship of altitude and rpm to the forward speed at which the critical Mach Number will be reached.

3–21. METHODS FOR RECOVERING FROM BLADE STALL OR COMPRESSIBILITY EFFECT.

3–22. Due to the similarity of the indications of blade stall and compressibility effect, it is difficult to determine which condition is occurring. If blade stall or compressibility effect is causing roughness in the helicopter during high speed flight or when maneuvering at lower speeds, either condition may be eliminated by accomplishing one or any combination of the following:

TABLE 3–I
COMPRESSIBILITY EFFECTS

ALTITUDE	AIRSPEED—KNOTS			
	2200 RPM	2300 RPM	2400 RPM	2500 RPM
SL	190	176	159	145
2,000	180	167	151	137
4,000	171	159	143	129
6,000	163	151	135	122
8,000	155	142	127	115
10,000	147	134	120	108
12,000	139	126	113	102
14,000	131	119	107	96

a. Decrease collective pitch.

b. Decrease severity of maneuver.

c. Decrease airspeed.

3–23. To stop nose pitch up, especially during turns at critical airspeeds and altitudes, gradually reduce collective pitch and/or rapidly increase rotor rpm and gently ease the nose of the helicopter down with smooth forward application of cyclic control. Level off by use of bottom tail rotor pedal and cyclic control. Avoid operation in thunderstorms and associated turbulent areas and, when in turbulent air, reduce airspeed to minimize the porpoising, as these conditions cause severe blade stall.

3–24. VISUAL INSPECTION AFTER ENCOUNTERING BLADE STALL.

3–25. The helicopter is designed with sufficient strength to withstand the loads encountered during blade stall. However, it is recommended that the helicopter be visually inspected, paying special attention to flight controls, main rotor blades, and the main rotor head. The flight control rods should be carefully inspected for bending and proper alignment. The main rotor blades should be inspected for bending of the spar and distortion of the pockets. The main rotor head should be inspected for cracks, especially in the vicinity of the pitch control horns and torque tube fillets.

3–26. If any of these components are bent or distorted, the entire rotor head and rotor head controls should be removed and returned for a major overhaul.

3–27. POWER SETTLING.

3–28. At high altitudes, high gross weights, or when operating with reduced power, it may not be possible to maintain level flight due to the lack of power developed by the engine, and settling will occur. The helicopter sinks into the air mass it has just displaced in trying to obtain lift, and the rotor blades are working continually in their own turbulent air stream. The attendant settling is of minor consequence, although at certain rates of descent and forward speeds, roughness and a partial loss of control may occur as indicated by ineffectiveness of the controls. Recovery from this condition is not readily made by increasing main rotor pitch and power; this will only reduce rotor speed or prolong the condition. However, recovery may be accomplished easily in the following manner:

a. Increase airspeed.

b. Decrease collective pitch.

3–29. Flight conditions causing power settling should be avoided at low altitudes because of the attendant loss of altitude necessary for recovery.

3–30. MINIMUM AND MAXIMUM SPEEDS FOR LEVEL FLIGHT.

3–31. Minimum airspeeds are a function of engine power available, which decreases with altitude due to the decrease in air density. Hovering flight, or flight at low airspeed, requires high power as little or no lift is developed by the forward motion of the helicopter. As airspeed is increased from zero, power required decreases as additional lift is gained from the forward movement of the helicopter. Power required for level flight reaches its minimum value between 50 and 80 knots, depending on gross weight, altitude, and rpm. Above this airspeed, power required will increase as airspeed increases because of the increase in drag and the power required to overcome it. Referring to chart 2–III, Chapter 14, it can be seen that as altitude increases, the helicopter is unable to hover. This condition is a result of the decrease in available power at altitude to a value less than the power required to hover. Above this point, some forward speed is necessary to reduce the power required for level flight to a value equal to the power available. As altitude increases, minimum airspeeds increase and approach the airspeed at which power required is minimum. If, when flying at altitude, the airspeed is permitted to drop below the minimum values on the curve for the specific gross weight and rpm condition, a loss of altitude will result. (Refer to paragraph 3–27.) This loss of altitude is of little consequence and produces no loss of control. Altitude may be recovered by increasing the airspeed above the minimum value specified on the curve for that particular altitude, gross weight, and rpm. The maximum permissible airspeeds are limited either by blade stall, compressibility effect, or in level flight by power required. As altitude increases, the airspeeds at which blade stall or compressibility effect occur decrease due to the decrease in air density and temperature. Decreases in air density require an increase in the angle of attack of the blades to produce the same amount of lift, and decreases in temperature result in a higher Mach Number which reduces the angle of attack at which blade stall occurs. Additional information on blade stall and compressibility effect is covered in paragraphs 3–11 and 3–19.

3–32. FLIGHT CONTROLS.

3–33. THROTTLE AND COLLECTIVE PITCH SYNCHRONIZATION.

3–34. Throttle settings are synchronized with movements of the collective pitch lever to retain approximately a constant rpm as collective pitch is increased or decreased. The synchronizer will operate when the throttle grip is prevented from rotating as the collective pitch lever is raised or lowered. The pilot may hold the grip or apply a sufficient amount of friction by means of the friction control knob to prevent the grip from rotating. If the throttle grip is permitted to rotate when changing pitch, the synchronizer will not operate correctly, resulting in insufficient increases in throttle setting when collective pitch is increased and sufficient decreases in throttle setting when collective pitch is decreased. Under certain loading or atmospheric conditions, proper synchronization may not be obtained. The throttle may then be used independently by rotating the grip. Although the synchronizer will increase engine power as collective pitch is increased, it is advisable to be prepared to further increase engine power by rotating the throttle grip to the left while increasing pitch to prevent a possible loss of rpm. During takeoff under certain conditions, it may be necessary to use almost full throttle before maximum power is obtained. Full open throttle may be obtained with a small increase in collective pitch at maximum rpm. If collective pitch is increased beyond the point where the throttle is full open, an override spring in the throttle linkage will extend and prevent damage to the system. Any increase in collective pitch above the point at which full throttle occurs will result in a loss of rpm.

3–35. PITCH CONTROL SERVO SYSTEM.

3–36. Pilot fatigue is reduced considerably by the installation of two flight control servo systems. The primary servos at the main rotor assembly and the auxiliary servos at the main rotor control mixing unit and in the tail rotor control cabling are both in operation at all times. Because of the servo units, the control forces are virtually eliminated and are constant throughout their full range. This may cause a tendency to overcontrol at first because there is very little feel in operating the cyclic stick. If either servo system should fail or malfunction, it may be turned off provided there is at least 1000 psi hydraulic pressure in the other system. Very little difference will be noticed by the pilot in the operation of the controls, unless the auxiliary servo system is inoperative; then the tail rotor control forces will be transmitted directly to the tail rotor pedals as there is no primary tail rotor servo.

3–37. COORDINATION OF FLIGHT CONTROLS.

3–38. The climb and descent of this helicopter is controlled primarily by raising or lowering the collective pitch lever; however, coordinated movements of the tail rotor pedals and cyclic stick are necessary to maintain a constant heading. When

collective pitch is increased to ascend, additional torque is developed by the main rotor. This torque must be compensated for by depressing left tail rotor pedal to increase the pitch and thrust of the tail rotor to the right. Sideward flight from hovering is accomplished primarily by lateral displacement of the cyclic stick; however, it is necessary to use tail rotor control to prevent the nose from swinging toward the direction of flight. When flying sideward to the right, the cyclic stick is displaced to the right and left tail rotor pedal is used to keep the nose of the helicopter in the original direction. For sideward flight to the left, the cyclic stick is displaced to the left and right tail rotor pedal is used. In hovering with no wind, no appreciable movement of the cyclic stick is necessary; however, with a wind condition, the cyclic stick should be held in the direction of the wind to maintain the same relative position above the ground. Turns while hovering are accomplished primarily by depressing the right tail rotor pedal for a right turn and left tail rotor pedal for a left turn. During the forward flight at low speeds, coordinated movements of the cyclic stick and tail rotor pedals are necessary to accomplish turns. In high speed flight, less tail rotor pedal displacement is necessary; in fact, turns can be accomplished by lateral movements of the cyclic stick only.

3–39. LEVEL FLIGHT CHARACTERISTICS UNDER VARIOUS SPEED CONDITIONS.

3–40. For hovering or low speed flight, high rotor rpm and manifold pressure are required because of the high power and control necessary. When, from hovering or low speed flight, increased forward speed is desired, the cyclic stick is moved forward. A momentary settling may occur with rapid acceleration and then the helicopter will begin to climb because the main rotor blades encounter an increased flow of air due to the forward movement of the helicopter. As the helicopter accelerates to approximately 50 knots, collective pitch and manifold pressure should be steadily decreased to maintain a constant altitude. To maintain the same altitude above approximately 80 knots, an increase in collective pitch and manifold pressure is necessary until maximum speed is reached. At maximum speed, a higher collective pitch setting is required than for hovering and engine rpm should be at 2500. It can be seen that power requirements, therefore, limit the maximum forward speed in level flight unless blade stall or compressibility is encountered beforehand. As forward speed is increased, the helicopter will assume an increasing nose-down attitude. This is caused by the fact that the main rotor blade flapping hinges are located at a distance from the center of the main rotor hub. When the rotor blade tip-path plane is tilted forward to increase forward speed, the centrifugal force of the blades will tend to align the plane of the rotor hub, and consequently the fuselage, with the forward tilted tip-path plane. Thus, for high speed flight, a slightly aft cg location will produce a more level fuselage attitude. An aft cg location imposes no limitation on forward speed through lack of forward cyclic control, though normal cyclic stick operation will be centered at a point further forward.

3–41. DIVING.

3–42. Maximum diving speed is limited to 150 knots at sea level or by blade stall or compressibility effect. For maximum diving speeds at various engine speeds and at altitude above sea level, see chart 3–I.

3–43. FLIGHT WITH EXTERNAL LOADS.

3–44. For external loads, techniques, and loading methods, refer to Chapter 13.

3–45. GROUND RESONANCE.

3–46. Helicopters equipped with hinged blades and a flexible landing gear are susceptible to some degree of instability during ground operation at certain rotor speeds. This condition, known as ground resonance, may occur at rotor speeds that produce a vibration having the same frequency as the natural frequency of the landing gear. Proper fluid level in the blade damper reservoir, proper maintenance of the blade dampers, and proper inflation of the landing gear oleo struts and tires will minimize the tendency toward ground resonance. The pilot should be prepared to take immediate corrective action should ground resonance occur or severe oscillations will build up so rapidly that damage to the helicopter will result. The occurrence of ground resonance can be minimized by observing the following precautions:

a. Stick trim system should be engaged in order to reduce pilot's tendency to aggravate condition by allowing cyclic stick to move with an oscillation which may have already started and would dissipate if cyclic stick were held stationary.

b. Oleo struts should be watched for any tendency toward undue binding during takeoff or landing.

c. Tail wheel should be locked during takeoff and landing.

3–47. To prevent the possibility of ground resonance occurring during takeoff, steadily increase

collective pitch until the wheels are clear of the ground. During landings, steadily decrease collective pitch, maintaining a minimum of 2500 rpm, until the wheels contact the ground. After touchdown, maintain 2500 rpm and smoothly reduce collective pitch to almost minimum to allow the helicopter to settle without delay to the static position of the oleo struts. After the helicopter has settled, reduce rpm for taxiing or engine shutdown. Should ground resonance occur after engine rpm has been reduced, immediately reduce collective pitch and close throttle and apply both the rotor brake and the wheel brakes.

CAUTION

If ground resonance should occur with high rpm, immediately increase power and take off. Resonance will stop when helicopter becomes airborne. If ground resonance should occur with low rpm, immediately reduce collective pitch, close throttle, and apply both rotor brake and wheel brakes.

3–48. Should the above procedures fail to eliminate ground resonance and permit a safe landing, assume the rotor head is in an out-of-balance condition or a damper is malfunctioning. When this condition occurs, it is recommended that the pilot attempt to land on softer terrain. If resonance is still encountered, hover the helicopter in an attitude that will permit deflation of the tires by any available method, such as removal of the valve cores or puncture of tires.

CHAPTER 9
SYSTEMS OPERATION
SECTION I
SCOPE

1-1. GENERAL.

1-2. This chapter provides additional information on the operations of various helicopter systems that are already discussed in other chapters. Lengthy and involved procedures are covered in this chapter to avoid overcrowding and destroying continuity of thought in the other chapters.

1-3. Special problems that may arise in the operations of the various systems are covered in this chapter.

SECTION II
SYSTEMS

2-1. ENGINE.

2-2. FUEL AIR MIXTURE.

2-3. Manual leaning is not permitted with this type carburetor. The RICH position of the carburetor mixture lever should be used for ground operation, takeoff, approach, power-off descents, landings, and all operations above military rated power. The NORMAL position of the carburetor mixture lever may be used for cruising flight up to and including military rated power as long as cylinder head temperature remains within limits and engine operation is normal.

2-4. CARBURETOR ICE.

2-5. Carburetor ice is of three different types: impact ice, formed by snow, sleet, or subcooled water in the atmosphere; throttle ice, formed on or near the throttle because of the cooling effect caused by restrictions in the carburetor throat; and ice formed by the cooling effect due to evaporation of fuel as it is sprayed into the air intake. Under certain atmospheric conditions, ice may form within the carburetor when the carburetor air temperature is much higher than 0°C. Indications of carburetor icing are: a decrease in manifold pressure resulting in loss of power; changes in fuel-air ratio, either richer or leaner as indicated by rough engine operation; and icing on other components of the helicopter. To prevent the formation of carburetor ice, maintain sufficient carburetor heat to keep the carburetor air temperature within the normal operating range. Removal of ice already formed is best accomplished by use of full carburetor heat. Other methods of eliminating ice are to increase the throttle or to change altitude to ice-free atmospheric conditions.

Note

Before applying carburetor heat, place the mixture lever in RICH position until engine operation stabilizes; then return to NORMAL.

2-6. BACKFIRING.

2-7. After a cold engine is started, the throttle should be increased slightly to produce an initial idling speed of 1100 rpm. If the throttle is opened too wide, it should be closed again quickly as the excessive amount of air admitted to the cold engine rapidly reduces the fuel-air mixture and may cause backfiring. Backfiring may also be caused by underpriming.

2-8. SPARK PLUG FOULING.

2-9. Spark plug fouling is the result of operating the engine at low speed and low rpm with an improper fuel air mixture. If the spark plugs should foul, idle the engine at 1000 ± 100 rpm for 2 minutes; then engage the hydro-mechanical clutch and perform the ignition system check. If roughness still occurs or the ignition system check is still unsatisfactory, the possible cause is an idling mixture that is too rich. Reduce engine rpm to 1200 and lean out the mixture with the mixture lever until lean best power mixture is obtained (25 to 50 rpm below maximum rpm with minimum manifold pressure) and idle the engine for 2 minutes. After idling for 2 minutes, place the mixture lever in the RICH position, engage the clutch, and repeat the ignition system check. If the ignition system check is still unsatisfactory, it is due to defective magnetos, spark plugs, or ignition leads.

Note

Operating the engine at high power in an attempt to unfoul the spark plugs may harden the substance on the plugs and foul them to a greater degree. Spark plugs that are marginal in their firing ability have their firing ability lessened by increasing heat and pressure in the cylinders.

2-10. CYLINDER HEAD TEMPERATURE.

2-11. To keep cylinder head materials at high operating strength, it is good practice to hold the cylinder head temperature within the green arc as shown in figure 2-1, Chapter 7. Cylinder head temperature may be controlled by regulating the carburetor air lever. Other means of controlling cylinder head temperature are by use of the mixture lever and throttle. A rich mixture will produce cooler operating temperatures than a lean mixture and a decrease in manifold pressure will also produce lower operating temperatures.

2-12. DETONATION.

2-13. Normal combustion produces a rapid but even burning of the fuel-air mixture in the combustion chamber. Detonation, on the other hand,

is a sudden violent explosion which transmits extremely high pressures and impact loads to the pistons, cylinders, and other components of the engine. Detonation produces a loss in power and causes a rapid increase in cylinder head temperature which may result in damage or failure of the engine. The increase in cylinder head temperature may cause a hot spot in the combustion chamber which will ignite the fuel-air charge far in advance of the spark timing. This condition is known as preignition and will further increase engine temperature. Conditions causing detonation are: excessive manifold pressure, excessive cylinder head temperature, excessive carburetor air temperature, advance spark timing, lean mixture, or grades of fuel with a lower anti-knock rating than is required by the engine. Methods of eliminating detonation are: to decrease manifold pressure and rpm, enrich mixture, and decrease carburetor air heat to reduce cylinder head temperature.

2–14. PRIMING.

2–15. The carburetor cannot supply the cylinders with a combustible mixture for starting, therefore, the initial charge must be accomplished through priming. The fuel booster pump must be used to supply the fuel pressure necessary for priming. The priming fuel is sprayed into the blower section of the engine where it is mixed with air from the carburetor and carried into the intake ports of the cylinders. As the engine is turned over, a spark from the induction vibrator ignites the fuel. Once the engine is started, sufficient air flow in the induction system is made available for operation of the carburetor. The amount of priming necessary for starting depends on air and engine temperature. If the engine is warm from previous operation, it is possible that there is a sufficient fuel charge remaining in the induction system for starting and no priming is necessary. Under all other conditions, priming is necessary.

2–16. OVERPRIMING. Overpriming will load the cylinders with fuel and make the engine difficult to start. An indication of overpriming is weak firing followed by dense, black smoke. In extreme cases of overpriming, the fuel will wash the oil film from the cylinder walls, pistons, and piston rings. Without this lubricating oil film, there is danger of scoring the cylinder walls and of piston seizure. This condition will be indicated by squeaking of the pistons when the engine is being turned over by the starter. Do not attempt to start the engine when this squeaking is heard until the spark plugs have been removed and the cylinder walls have been sprayed with fresh oil. When the engine has been slightly overprimed and will not start and the squeaking is not heard or hydraulic lock is not indicated, the engine may be turned over by the starter for several revolutions with the ignition switch in the OFF position and the mixture lever in the IDLE CUT-OFF position. Repeat the starting procedure with little or no priming.

2–17. UNDERPRIMING. Underpriming is indicated by failure of the engine to start, erratic running, weak firing with insufficient energy to turn the engine over, puffs of white smoke, and backfiring. When any of the above conditions occur, check that the fuel selector valve handle is properly set and that there is sufficient fuel pressure for priming. Additional priming should be done cautiously.

2–18. TRANSMISSION SYSTEM.

2–19. HYDRO-MECHANICAL CLUTCH.

2–20. The hydro-mechanical clutch, which provides the engagement between the engine and transmission system, is comprised essentially of a fluid coupling and a mechanical coupling. The fluid coupling is used to accelerate the rotor system to a speed at which mechanical engagement can be accomplished. The fluid coupling consists of two sets of vanes enclosed in a housing. The vanes face each other and rotate about the same axis, but are not connected to each other. One set of vanes, the driving vanes, is attached to the engine shaft and rotates at engine speed. The second set of vanes, the driven vanes, is attached to the main transmission drive shaft. The mechanical coupling consists essentially of a freewheel unit, a flyweight assembly, and a blocker plate. Rotor engagement is begun by pumping engine oil into the fluid coupling. On helicopters serial No. prior to 56-4313, rotor engagement is accomplished by a pump mounted on the top of the left oil tank. On helicopters serial No. 56-4313 and subsequent, rotor engagement is accomplished by opening a diverter valve which directs the flow of oil from the engine scavenge pump into the fluid coupling. When the oil enters the fluid coupling, it is impelled by the driving vanes. This motion is transmitted through the medium of oil to the driven vanes, and a smooth acceleration of the rotor system begins. The rotor system is accelerated to approximately 135 rotor rpm by the fluid coupling to effect a mechanical engagement. During the above procedure, the blocker plate in the mechanical coupling prevents mechanical engagement. When the rotor system is accelerated to 135 rotor rpm, throttle is decreased to drop engine rpm below the corresponding rotor rpm. The decrease in engine rpm permits the blocker plate to slide into a position which will release the flyweights. The centrifugal force of the flyweights places the freewheel unit in operation. Engine rpm is then gradually increased until the engine pointer

and tachometer pointer are in line and the mechanical engagement is completed. If a rolling tendency is encountered during the engagement, as rotor speed accelerates through the range equivalent to 600 engine rpm, it may be alleviated by increasing engine speed to create a more rapid acceleration of the rotor system. The clutch is disengaged by closing the throttle. When main rotor speed has dropped to approximately 110 rotor rpm, a spring in the mechanical coupling will override the centrifugal force created by the flyweights, thereby disengaging the mechanical coupling.

2–21. On helicopters equipped with a clutch pump (prior to serial No. 56-4313), difficulty in clutch engagement or an insufficient amount of oil for clutch engagement may arise when the left side of the helicopter is higher than the right. In this condition, a certain amount of oil may pass from the left engine oil tank to the right engine oil tank by way of the interconnecting tubing where the oil is trapped. The oil level in the left tank is thus lowered and the pump, located on the top of the left tank, has less available oil for clutch engagement purposes. Difficulty will also be encountered in clutch engagement if the oil tanks are not filled to the prescribed level.

2–22. On helicopters equipped with the diverter valve (serial No. 56-4313 and subsequent), the flow of oil to the fluid coupling is dependent on oil temperature. When engine oil temperature is low, the flow of oil to the fluid coupling is also low. This may cause engine rpm to surge and rotor rpm not to accelerate beyond a certain point. When engine surging is encountered, decrease engine rpm below the equivalent rotor rpm; then slowly advance throttle to accelerate the rotor system. This procedure will increase the oil temperature, thereby increasing flow to the fluid coupling and may be repeated, if necessary.

2–23. Consistent clutch engagements in a minimum amount of time can be obtained with a slow, steady advancement of throttle. Pilots who have been accustomed to the operating technique associated with the clutch pump equipped aircraft are familiar with the fact that after the clutch pump has been actuated, a steady advancement of the throttle is not critical, because once the clutch pump is in operation the flow of oil to the clutch is considerably higher than the amount being supplied by the engine sump pump in the diverter valve applications.

2–24. FUEL SYSTEM MANAGEMENT.

2–25. Fuel is transferred from the aft and center fuel tanks into the forward tank by a transfer pump located in the sump of each tank. Check valves in the fuel transfer line prevent fuel from being transferred aft. In order not to exceed the range of cg travel, the aft tank should be emptied first, then the center tank, and lastly the forward tank. Both transfer pumps should not be in operation at the same time, but one or the other should be in operation as long as fuel remains in the aft or center tanks. Before starting the engine, the aft transfer pump is turned on. When the aft no-transfer warning light comes on, the fuel quantity in the aft tank should be checked on the fuel quantity gage. If the aft tank is empty, turn off the aft transfer pump and turn on the center pump. When the center tank is empty, turn off the center transfer pump. If either no-transfer warning light comes on and its tank is not empty, a malfunction is indicated and the emergency gravity feed system, which drains all three tanks at an approximately equal rate, must be used. (Refer to paragraph 4–6, Chapter 4.)

2–26. FLIGHT CONTROL SERVO UNIT MALFUNCTION.

2–27. The following information amplifies the discussion on servo unit malfunction. Procedures to be followed in event of servo unit malfunction are contained in paragraph 4–38, Chapter 4. As previously discussed, primary servo unit malfunction is identified by coupled indications, and auxiliary servo unit malfunction is identified by uncoupled indications.

2–28. COUPLED INDICATIONS.

2–29. HARD-OVER SIGNAL IN PRIMARY SERVO. A hard over in the primary servo can be caused by:

a. A broken pilot valve or feedback link.

b. A maladjusted pilot valve or connecting link.

c. A malfunctioning feedback linkage.

2–30. To all intent and purposes, the end result is the same in all three cases, and serves to pressurize one side of the servo actuator creating a constant force tending to drive the controls in one direction. The output of the auxiliary servo system auxiliary is greater than the output of the primary servo system. The auxiliary servos can, therefore, resist the efforts of a hard over in a primary servo as it attempts to drive the controls to one extreme. In practice, the auxiliary servo system margin of force superiority is limited and the addition of vibratory or steady flight loads tending to aid the hard-over signal will be capable of overpowering the auxiliary servo. The resultant load in excess of the auxiliary servo output will feed into the pilot's controls. Depending on the initial direction of the steady load, the effects, as felt by the pilot, may take different forms.

2–31. If the steady force is large and acting in a direction to aid the hard-over signal, the affected control would tend to drive to an extreme position. In this instance, the pilot's natural response would move the flight controls through the lost motion in the auxiliary servo sloppy link; the flight controls then bottoming in the slop eliminator cam. The pilot can now exert a manual effort which would normally be sufficient to maintain control. In an extreme flight condition, the force required may be as high as 100 pounds. Depending on the magnitude of the vibratory load, it is probable that a force reversal would intermittently relieve the pilot effort requirements so that the end result, as felt by the pilot, would be a vibratory load with a steady force tending to drive the stick in a particular direction. Due to the action of the flight control mixing unit, the effect would be felt simultaneously on the affected cyclic channel plus the collective.

2–32. A second condition wherein the vibratory load is large, the result, as felt by the pilot, would again be an intermittent unidirectional load which he has to overcome.

2–33. A third case would include a hard-over failure in the presence of relatively small flight loads. In this instance, the feel to the pilot might vary from essentially normal, if the steady force is acting to aid the auxiliary servo output, to a sluggish response in one direction (the direction opposing the hard-over signal). This is perhaps the most difficult condition to recognize inasmuch as the symptoms are the least obvious. However, it also requires the least need of urgency by the pilot. The collective pitch channel, plus the affected cycle channel, should simultaneously give indication of malfunction.

2–34. JAM IN PRIMARY SERVO. A jam in the primary servo could be affected by:

a. A mechanical bind of the pilot valve when in the neutral position.

b. Blockage of the return metering ports of the servo valve sleeve.

2–35. In the first instance, the affected primary servo is immovable in both directions. As felt by the pilot, the collective pitch lever and the malfunctioning cyclic stick are free to move within the limits of the auxiliary servo system sloppy link (about one-half travel). At the extremes of the sloppy link travel, a mechanical stop is encountered and additional motion of either the collective lever or the cyclic stick is possible only by trading motion with the opposite one. For example, if collective pitch and fore and aft are the affected controls, forward motion of cyclic stick beyond that allowed in the sloppy link is possible only by simultaneous motion of the collective pitch lever in the up direction.

2–36. The second case, that of blockage of the return metering port, gives similar indication but is unidirectional only. That is to say, the servo would function normally in one direction but would be immovable in the other; any motion in the normal direction being irrecoverable. Again, for control motions attempting to drive the servo in the immovable direction, there would be considerable free motion of the collective pitch and the affected cyclic stick control within the limits of the sloppy link; additional cyclic stick motion coming only by trading collective pitch lever for cyclic stick motion.

2–37. UNCOUPLED INDICATIONS.

2–38. HARD OVER IN AUXILIARY SERVO. A hard over can be caused by:

a. A broken pilot valve or feedback link.

b. A pilot valve or connecting linkage that has gone badly out of adjustment.

c. Improper action of the feedback linkage preventing proper servo followup. Should the first or second of these possibilities occur in the auxiliary servo, the power piston of the affected channel will drive to its extreme position. Depending on the initial position of the affected flight control, it may or may not be driven through part of its travel. Due to the amount of additional motion required in the auxiliary sloppy link for the ASE function (CH-34C), the pilot will apparently be able to retain about one-fourth of the total control motion before encountering a mechanical stop. Actually, none of this motion is effective since the auxiliary power piston cannot be moved from its initial extreme position.

2–39. Should the third of these possibilities occur, the result would be constant force driving the cyclic stick to its extreme position. Depending on the severity of the malfunction in the sloppy link, the pilot may be able to override the force and, thereby, retain cyclic control over the power piston position. In extreme cases, the cyclic stick can be driven to its stop, then be rigidly fixed in this position. A lack of control is evidenced in one channel only.

2–40. MALADJUSTMENT OF SERVO VALVE ON HELICOPTERS WITH AUTOMATIC STABILIZATION EQUIPMENT (ASE) (MODEL CH-34C).

2–41. ASE signals are introduced into the control system at the auxiliary servo and, therefore, into the unmixed portion of the controls. This is accomplished through an electric motor driving a

jack screw. Mechanical stops serve to limit the total jack screw travel consistent with the limited authority concept. This means that with properly adjusted servo valve, there is sufficient travel within the sloppy link cam for the pilot to override a full displacement ASE input. Normally, in a condition of equilibrium, the feedback linkage is neutrally positioned relative to the sloppy link cam, and in addition, the electronic error signal is zero so that the jack screw is neutrally located relative to its stops. If a servo valve becomes slightly maladjusted, this equilibrium condition becomes upset. To resume the helicopter's equilibrium, ASE will impose a steady state error reflected as a null shift of the jack screw from its geometrical neutral position. The bearing and slop eliminator cam relationship remains essentially unchanged. In the resulting system, the jack screw can traverse less than its normal range from the new null position in one direction and more than the normal travel in the opposite. It is this extra amount of travel in one direction which can provide a recognizable symptom since if the jack screw travels to its distant stop in response to an ASE signal, the free motion allowed in the sloppy link cam may be insufficient to permit proper feedback. The result is a force driving the cyclic stick in one direction in the affected channel as long as the ASE servo motor position is biased sufficiently to make the maladjustment critical.

2–42. The frequency and extent of these unidirectional, single channel cyclic stick forces will, therefore, vary depending upon the instantaneous ASE motor position and, hence, the helicopter flight condition and the degree of pilot valve maladjustment. For example, an auxiliary servo with a maladjusted valve might behave normally until the ASE called for a large correction at which time the maladjusted valve would suddenly be manifested for the first time as a force on the pilot's control.

2–43. JAM IN AUXILIARY SERVO.

2–44. A jam in the auxiliary servo may be created by:

a. A physical binding of the servo valve in the neutral position.

b. The blocking of the return metering ports in the servo valve sleeve.

2–45. In the first instance, the result is an immovable stick. In the second case, motion of the controls is normal in one direction. However, motion in the opposite direction is possible only within the limit of the sloppy link and this motion is not effective in positioning the power piston. The resulting system, therefore, is in effect a ratchet, any input motion in the normally functioning direction being irrecoverable. A ramification of this second case might be considered in the case of a pressure metering port on the sleeve being blocked. Again, the control would function normally in one direction. Motion in the opposite direction, however, would be effective only after the cyclic stick had moved through the limit of the sloppy link. Further cyclic stick motion would effectively position the power piston but would require a cyclic stick force sufficient to overcome the spring effect of a cavitating hydraulic cylinder (the power piston). The malfunction is evidenced in one channel only.

2–46. AUTOMATIC STABILIZATION EQUIPMENT (ASE) (MODEL CH-34C).

2–47. A description of the automatic stabilization equipment is given in Chapter 5, and normal operation is covered in Chapter 3. A more detailed account of the equipment is covered in the following paragraphs.

2–48. In addition to the ASE control panel and the push buttons on the cyclic stick grips, the major components of the equipment consist of a control gyro and amplifier assembly located in the transmission compartment and a barometric altitude control and a directional gyro compass located in the electronics compartment. Three servo motors that control altitude, roll, and pitch are part of the main rotor auxiliary servo unit located behind the motor box assembly in the pilots' compartment. A fourth servo motor, controlling yaw, is part of the tail rotor auxiliary servo unit located on the aft left side of the transmission compartment.

2–49. The sensing signals for the equipment furnished by the elements listed below are fed directly into the amplifier except the yaw and altitude signals. The yaw signals furnished by the directional gyro compass system are modified by adjustment of the yaw trim knob on the ASE control panel and are then fed into the amplifier. The pitch and roll signals are provided by a vertical gyro inside the amplifier. The barometric altitude signals are provided by the barometric altitude control which is connected to the static port over the electronics compartment.

2–50. In the amplifier, rate signals associated with all sensing signals are electronically derived, mixed with the sensing signals, and amplified. These signals are then fed to the motor box where they are further amplified and fed as input signals to drive the servo motors. The servo motors actuate the pilot valves which, in turn, control the power pistons of the auxiliary servo system which actuate the flight controls. Attached to each servo motor is

a displacement transducer and a tachometer-generator which provide voltages proportional to servo motor output. These voltages are fed back into the amplifier and reintroduced to the servo motor to smooth out the automatic stabilization equipment corrective action and prevent excessive overshooting.

2–51. With the equipment engaged, the stabilized behavior of the helicopter is controlled by conventional use of the flight controls. Pitch and roll stick cancellers, located in the linkage under the pilots' compartment floor, sense the motions of the cyclic stick and feed proportional voltage signals into the amplifier when the stick is moved. The vertical gyro senses the pilot induced attitude change and also sends a signal to the amplifier. The stick canceller signals, in effect, nullify this signal from the vertical gyro and retain the helicopter in the new attitude corresponding to the new stick position. When one or both tail rotor pedals are depressed (opening the microswitches and cancelling the directional signals to the automatic stabilization equipment), the pilot or copilot has full command of the rate of turn except as limited by the tail rotor pedal damper. When the feet are on the pedals, this switch circuit is opened and no directional sensing signal is fed into the amplifier. Simultaneously, a circuit in the yaw channel of the amplifier is closed which nullifies the yaw signal. After the desired heading has been assumed, and as soon as the feet are removed from the pedals, the directional sensing signal is again fed into the amplifier and the nullifying circuit is opened. The helicopter will then stabilize on the new heading and will not return to the original heading. Heading changes may also be made by slowly turning the yaw trim knob on the ASE control panel.

2–52. With the barometric altitude mode in operation, the collective pitch lever may be used to override the automatic stabilization equipment; however, no cancelling and nulling device is incorporated in the altitude channel. When the altitude change is desired, the BAR ALT OFF button must be depressed, and the helicopter must be brought to the new altitude and trimmed approximately to a zero rate of climb. After speed, power, and altitude have stabilized, apply sufficient friction to the collective pitch lever to prevent creeping, then reengage the BAR ALT button on the ASE control panel. If the BAR ALT button is not disengaged when changing altitude, the helicopter will attempt to remain at the altitude at which the BAR ALT button was depressed. In addition to the OVERRIDE CHECK switch, the motor box is fitted with a guarded rotary switch, marked NULL IND CONTROL CHANNEL SELECTOR, which permits use of the null indicator on the ASE control panel to monitor the motion of all servo motors. Normally, the NULL IND CONTROL CHANNEL SELECTOR switch is kept in the PITCH position so that the indicator can be used with the cg trim knob to adjust for shifting cg. A third switch on the motor box, when actuated to the MOTOR INPUT position, transforms the null indicator into a voltmeter in order to check the input error voltages to the servo motors. There are four CHANNEL DISENGAGE switches which will disengage any one of the ASE channels when placed in the OFF position. This arrangement is to prevent complete shutdown of the ASE in the event of one channel malfunctioning. Also accessible on the outside of the motor box are the TACH GEN and F.U. NULL adjustment potentiometers. These are set when leaving the factory and, except for system alignment of overhaul, should not be disturbed.

2–53. Since the authority of the automatic stabilization equipment on all channels is limited to a fraction of total control travel, any emergency override in case of malfunction may normally be achieved by introducing a manual control correction. Under these circumstances, however, a jumpy control movement caused by servo motor action may be disconcerting. This can be eliminated by pressing the AUTO STAB RELEASE button on the cyclic stick. A second step is to turn off the auxiliary servos to eliminate the action of the servo motors from the flight control system.

CHAPTER 10
WEATHER OPERATIONS
SECTION I
SCOPE

1–1. GENERAL.

1–2. The purpose of this chapter is to inform the crew of the special precautions and procedures to be followed during the various weather and climatic conditions that may be encountered in flight.

1–3. With the exception of some possible repetition of text necessary for emphasis, clarity, or continuity of thought, this chapter contains only those procedures that differ from, or are in addition to, the normal operating instructions found in Chapter 3. Any discussions relative to systems operation are covered in Chapter 9.

SECTION II
INSTRUMENT FLIGHT

2-1. NIGHT FLYING.

2-2. Night flying presents the same problems as instrument flying, plus additional problems introduced by illumination of the instruments and pilot's compartment, and by exterior reflections.

Note

Rotating anti-collision light should be turned off during flight through actual instrument conditions. With light on during instrument conditions, pilot could experience vertigo as a result of rotating reflections of light against clouds. In addition, light would be ineffective as an anti-collision light, during instrument conditions, since it could not be observed by pilots of other aircraft.

WARNING

During an instrument approach with pilot's compartment lights at high intensity, pilot will not detect "break out" as soon as he would with pilot's compartment lights turned low.

WARNING

Engine exhaust illuminates surrounding clouds with an effect similar to lightning. This destroys night adaptation and makes instrument reading difficult even with instrument lights full bright. With this glare, presence of a thunderstorm is difficult to determine. Dome light, spotlight, and instrument lights should all be turned to full intensity prior to entering clouds to prevent temporary blindness. Since extreme difficulty is encountered when attempting to read necessary publications, adequate flight planning and services of a copilot are recommended.

2-3. TAKEOFF PROCEDURE.

2-4. There is basically little difference in the technique used on night takeoffs from that used in day operations. Care should be taken to make a clean decisive break from the ground to a safe hovering altitude. The landing light should be used to illuminate the ground. Position the beam of the landing light to provide a good forward reference.

CAUTION

The landing light should be positioned for immediate use in the event of an emergency.

2-5. The effect of the landing light improves as the helicopter is brought to a hover. The use of landing lights is discretionary with the pilot, as he can best judge conditions.

2-6. LANDING PROCEDURE.

2-7. The landing light is recommended for all landings. In poorly lighted or unlighted areas, the landing light can be used to clear the landing area prior to landing. The landing light can be preset for landing or adjusted throughout the final approach. Care should be taken to correct for side drift prior to contacting the ground.

2-8. OPERATION UNDER INSTRUMENT FLIGHT CONDITIONS.

2-9. This helicopter is limited in its operation during instrument flight conditions. It is restricted from flight in areas of heavy turbulence and ice because of the possibility of encountering blade stall and the lack of de-icing equipment. Flight under instrument conditions for sustained periods of time should be avoided unless the helicopter is equipped with automatic stabilization equipment. A pilot and copilot are required on all instrument flights; both must be helicopter instrument qualified. Intentional operation under instrument conditions should not be attempted unless detailed planning for such a mission has been previously completed. The pilot not contemplating intentional instrument flight should always be aware of his position and alternate landing sites so that if inclement weather is encountered, he may land immediately or take steps to avoid any further flight in this area.

WARNING

If instrument flight conditions are inadvertently encountered, pilot should establish a constant heading and altitude while maintaining a constant power setting. These items should be established prior to attempting any maneuver to regain visual flight conditions. After helicopter is stabilized, normal turns and descents can safely be made to make exit from weather area. Turns should not exceed 15 degrees of bank.

2–10. PRACTICE AUTOROTATIVE DESCENT.

2–11. For the technique to be used if an emergency autorotative descent on instruments is required, refer to paragraph 2–20, Chapter 4.

WARNING

Practice autorotative descents under actual instrument conditions are prohibited. However, they are permitted if practiced under simulated (hooded flight) conditions.

2–12. INSTRUMENT PROCEDURES.

2–13. The instrument procedures for this helicopter are the same as standard instrument flight procedures in other single rotor helicopters. (Refer to Appendix I for appropriate publication.)

SECTION III

COLD WEATHER OPERATIONS

3-1. COLD WEATHER PROCEDURES.

3-2. The major problems in cold weather operations are in the preparation for flight, the restrictions to visibility as a result of blowing snow (from the rotor wash) especially during landings and takeoffs, and the ever present possibility of breaking through ice surfaces or hidden snow crust during landings.

CAUTION

When operating in cold weather conditions, ascertain that helicopter has been serviced with the proper lubricants. (See figure 2-29, Chapter 2.)

Note

Human efficiency is reduced sharply as temperatures drop below −18°C (0°F). In arctic and sub-arctic operations, rotor wash is known to have a supercooling effect which may reduce efficiency of exposed personnel as much as may be expected by a 11°C (52°F) drop in temperature. Consequently, exposure of survivors being evacuated or of ground personnel to rotor wash should be held to to a minimum.

3-3. EXTREME COLD WEATHER STARTING PROCEDURE.

3-4. Engine cylinder head temperature below −12°C (+10°F).

a. Throttle – CLOSED.

b. Starter – ENGAGE.

CAUTION

Crank engine for 3 to 5 seconds by energizing starter to check for hydraulic lock. If there is unusually high compression, have spark plugs removed from lower cylinders and all liquid drained from cylinders. The presence of any quantity of liquid in combustion chamber is likely to cause serious damage to engine.

c. Engine Primer Button – CONTINUOUS.

d. Ignition Switch – BOTH (IMMEDIATELY AFTER PRIME).

e. Mixture Lever – RICH.

CAUTION

Should engine fail to start within a short period of time, place mixture lever in IDLE CUT-OFF and release engine primer button.

Note

After engine starts, it will motor at low speeds. This is satisfactory. Attempts to gain normal idle speeds by opening throttle too soon may result in engine stoppage and iced spark plugs. Use of primer in addition to mixture may be necessary to maintain smooth engine operation. Release engine primer button when a drop in engine rpm is noted.

3-5. ENGINE GROUND OPERATION.

CAUTION

Engine oil pressure gages should be monitored frequently to assure proper engine lubrication.

3-6. TAKEOFF.

WARNING

In cold weather, make sure all instruments have been warmed up sufficiently to insure normal operation. Check for sluggish instruments during taxiing or warmup.

3-7. CRUISE CHECKS.

3-8. During flight, insure continued availability of cyclic and collective servo control and cabin heat. Continued flight with loss of either cabin heat or flight control servos should be made with extreme caution.

TABLE 3–I

OIL DILUTION
TIME VS TEMPERATURE

AIR TEMP		TIME	PERCENT
°C	°F	MINUTES	DILUTION
−12	+10	2	10
−29	−20	4.5	20
−46	−50	8.5	30

3–9. ENGINE SHUTDOWN.

3–10. OIL DILUTION. When a cold start is anticipated, the engine oil should be diluted with fuel to retain oil fluidity at low temperatures.

Note

Check quantity of oil in tanks prior to accomplishing oil dilution.

a. Idle engine at 1100 to 1200 rpm until oil temperature falls to 40°C.

Note

Dilution of engine oil should not be accomplished with oil temperature above 50°C, since heat of oil will evaporate some fuel, resulting in a lack of proper dilution.

b. Open oil dilution manual shutoff valve handle forward of oil cooler.

c. Fuel booster pump switch – FUEL BSTR PUMP.

d. At 1100 to 1200 rpm, hold switch in OIL DIL position for required dilution period. (Refer to table 3–I.)

CAUTION

At no time should engine be operated with less than 15 psi oil pressure.

Note

A drop in fuel pressure is an indication that oil dilution system is functioning.

3–11. BEFORE LEAVING THE HELICOPTER.

3–12. After the engine and rotors have stopped, protective covers should be installed. If the helicopter is to remain unsheltered at temperatures below −29°C (−20°F), the battery should be removed to a heated area.

3–13. ICE, SNOW, AND RAIN.

3–14. The problem of major concern in the ice, snow, and rain operation of helicopters is the restriction to visibility, especially during landings and takeoffs and the ever present possibility of breaking through ice surfaces or hidden snow crust during landings. This problem is of paramount importance when operating from other than an operational air base. The restriction to visibility caused by blowing snow can be partially overcome by utilizing smoke grenades or some other object distinguishable in color (such as pine boughs, painted jerry can, or emergency kit) placed or implanted in the landing area for reference. The smoke grenade will reveal the wind direction and allow an estimate of its speed. The danger of breaking through ice or hidden snow crust is minimized by maintaining maximum rpm when resting on an unknown surface. Pilots should be aware of the fact that the horizon may be lost when flying over large unbroken expanses of snow. If such a situation exists, the helicopter should be flown entirely by instruments at a safe instrument altitude. Colored glasses should be worn in snow areas to prevent snow blindness.

WARNING

Flights during icing conditions should not be made because of insufficient anti-icing and de-icing equipment. Except in extreme emergencies, night takeoffs and landings should not be attempted on loose or powdery snow surfaces.

3–15. EXTERIOR INSPECTION.

3–16. In accomplishing the exterior inspection, the main rotor system, particularly the main blade dampers, should be checked for freedom of movement. The dampers may be checked from the main

gear box platform by rocking the main rotor blades fore and aft.

CAUTION

Remove all ice accumulations prior to flight.

3–17. When taking off from other than prepared surfaces, brush all crusted snow from the fuselage and landing gear. If the fuselage is resting on the surface of deep snow, tramp down the snow around the fuselage and landing gear to break loose any crusted snow. Check engine air intake screen, pitot tube, oil vent line, and fuel tank sump drains to determine that they are free from snow or ice. The pilot must ascertain that the helicopter is completely broken free of snow crust. A slight yawing movement, induced by light tail rotor pedal motion with throttle near maximum rpm, should be made to break the wheels and/or fuselage undersurface free from any possible seizing.

CAUTION

There is a possibility of fuselage becoming frozen to a snow surface. This could happen when underside of fuselage, at a temperature slightly above freezing, comes in contact with a cold snow surface, or when snow surface is thawing and subsequent outside air temperature drops below freezing. There is also a possibility of a wheel becoming lodged under a heavy crust of snow. Either of these conditions could result in an accident during takeoff, especially during a maximum performance takeoff. If it cannot be positively ascertained that helicopter is completely free when it becomes light just prior to takeoff, takeoff should be aborted and action taken to free helicopter.

3–18. GROUND OPERATION.

3–19. Check that ice chocks are used on the main landing gear wheels due to the minimum traction afforded on snow and ice surfaces to counteract torque during clutch engagement and ground tests.

3–20. TAXIING.

3–21. Little difference will be noted between normal taxiing and taxiing on ice or snow. Helicopters should not be taxied on an ice or snow covered surface other than on hard surfaced areas of an air base.

CAUTION

Use caution when taxiing on surfaces covered with ice or snow because of the minimum braking action available.

3–22. TAKEOFF.

CAUTION

Takeoff is prohibited with snow or ice on helicopter. Failure to remove snow and ice accumulated while on ground can result in serious aerodynamic and structural effects when flight is attempted. Takeoff, hovering, and climb-out performance, as well as stall speeds and handling characteristics, can be adversely affected. Unbalanced loads of snow and ice will result in heavy vibration in flight causing severe structural damage. These hazards can be eliminated by removing all snow and ice accumulations prior to flight. In taking off from large expanses of solid unbroken snow cover, smoke grenades or markers should be used for maintaining visual reference until altitude is gained.

3–23. Ice takeoff from an air base may be considered normal, except for the following precaution that should be observed. The pilot must ascertain that the helicopter is broken completely free of ice. A slight yawing movement, induced by light tail rotor pedal motion with throttle near maximum rpm, should be made to break the wheels free from any possible seizing.

3–24. Snow takeoffs may be considered normal except for the following precautions that should be observed. Select an area devoid of loose or powdery snow to minimize the restriction to visibility from blowing snow. If no area is available, increase engine speed to maximum rpm. If the rotor should stir up snow, the best method would be to increase pitch and take off; do not hover, but continue to climb rapidly. The swirling snow will be the most dense immediately after takeoff until 30 to 50 feet altitude is obtained at which time a normal climb can be established. (Refer to paragraph 2–39, Chapter 3.

WARNING

Hoist operation over loose or powdery snow should not be attempted unless a hovering altitude above swirling snow can be maintained.

3–25. CRUISE CHECKS.

3–26. The radio compass is susceptible to static caused by precipitation. Therefore, when flights are made during these conditions, the pilot should expect poor radio range reception.

WARNING

During icing conditions, main rotor assembly and blades will collect ice. After a sufficient amount has accumulated, vibration or feedback will be felt in cyclic stick. An unbalanced blade condition, with probable loss of control, will result when portions of ice are thrown from rotor blade. A landing should be made as soon as ice is detected.

Note

Windshield wipers may not operate properly above 40 knots and forward visibility may become distorted or obscured by precipitation. However, limited visibility is possible through side windows.

3–27. LANDING.

3–28. Ice landings at an air base may be considered normal, except for the following precaution that should be observed. Accomplish a normal landing with a minimum hover before touchdown.

CAUTION

Droop stops may not function properly during shutdown if helicopter has been flown during icing conditions. In event of droop stop malfunction, cyclic stick should be held well forward of the neutral position to insure maximum tail cone clearance.

3–29. Loose powdery snow and crusts (surface and hidden) should be anticipated on all landings on snow. Accomplish an approach with minimum hover before touchdown to minimize the rotor wash on loose powdery snow. Reduce engine rpm as soon as it is determined that the helicopter is on solid ground. Limited visibility will result if hovering is attempted before touchdown. If possible, landing should always be made where visual ground reference can be maintained. The reference point should be kept immediately forward and to the right so that it will be visible to the pilot at all times.

3–30. ENGINE SHUTDOWN.

3–31. For engine shutdown procedures, refer to paragraph 2–94, Chapter 3.

SECTION IV
DESERT AND HOT WEATHER OPERATIONS

4-1. HOT WEATHER OPERATION.

4-2. More power will be required to hover during hot weather than on a standard day. Hovering ceilings will be lower for the same gross weight and power settings on a hot day. Maximum rpm should be maintained at all times to insure sufficient power and control, especially during takeoffs and hovering. Chart 2-IV, Chapter 14 shows hovering ceilings with various conditions of temperature, gross weight, head wind, and specific humidity.

4-3. CARBURETOR AIR TEMPERATURE.

4-4. When operating in hot weather, it may not be possible to hold carburetor air temperatures below 40°C. When carburetor heat is not being utilized and a check of all other engine operating instruments indicates normal operation, no maximum carburetor air temperature will apply.

Note

For each 6°C rise in carburetor air temperature above 15°C, the available engine horsepower is reduced 1 percent.

4-5. DESERT OPERATION.

4-6. The major problem in desert operations is the restriction to visibility as a result of the dust cloud created by the rotor wash. Consequently, takeoffs, cargo sling load operations, and landings in sandy or dusty areas must, at times, be made without reference to the horizon and surrounding objects. This restriction to visibility can be overcome by proper use of the pilot's landing light. Operation in dusty or sandy areas can also be harmful to the engines. Use of the carburetor air filter will help to minimize damage to the engine.

4-7. BEFORE ENTERING THE HELICOPTER.

4-8. The helicopter should be towed into takeoff position, which, if at all possible, should be on a hard, clean surface, free from sand. After the helicopter is towed into position, accomplish the normal exterior inspection. (Refer to paragraph 2-18, Chapter 3.) Perform the following in addition to the requirements of figure 2-3, Chapter 3.

a. Oleo struts – CHECK FOR PRESENCE OF SAND AND GRIT. HAVE PERSONNEL CLEAN IN ACCORDANCE WITH APPROVED METHODS, IF NECESSARY.

b. Rotor blades – CHECK FOR EVIDENCE OF SAND ABRASION.

c. Protective covers – REMOVED.

d. Fuselage – CHECK FOR SAND THAT HAS FILTERED THROUGH OPENINGS.

e. Carburetor air filter – CHECK FOR SAND CLOGGING.

f. Engine and main gear box oil coolers – CHECK FOR SAND CLOGGING AND CONTAMINATION

4-9. ON ENTERING THE HELICOPTER.

4-10. Open all vents, windows, and doors to increase ventilation. Turn on ventilation system as soon as an external power supply is available. Perform the normal interior inspection. (Refer to paragraph 2-19, Chapter 3.)

4-11. ENGINE STARTING AND GROUND OPERATION.

CAUTION

Do not start engine during a dust or sand storm, unless absolutely necessary, to avoid danger of drawing sand into carburetor induction air intakes resulting in premature wear of engines.

4-12. If possible, engine starting and ground operation should be accomplished from a hard, clean surface. This is extremely important after rotor clutch engagement as the downwash from the main rotor will stir up clouds of sand. Accomplish the normal engine start as presented in paragraph 2-22, Chapter 3. Limit ground operation of the engines to a minimum. Every effort should be made to minimize blowing the sand up around the main rotor assembly and the engine by utilizing minimum pitch and engine rpm.

CAUTION

Use filtered air to minimize engine contamination.

4–13. TAKEOFF.

4–14. Increase engine to maximum rpm. If the rotor should stir up dust and sand, it would be best to increase collective pitch and take off; do not hover in ground effect, but continue to climb rapidly. (Refer to paragraph 2–39, Chapter 3.) Takeoffs, unless necessary, should be avoided during a dust or sand storm.

4–15. CRUISE CHECKS.

4–16. When sand storm conditions are encountered, evasive action should be taken to prevent extensive damage to the helicopter, particularly to the rotor blades and engine. If the storm area is not too extensive, it may be possible to fly over or around it, but never through it. If practicable, return to the base so that the helicopter may be tied down and all protective covers installed. If this is not possible, land and shut down. Head the helicopter into the wind, and if possible, tie down the blades. Close all doors, windows, and vents and remain in the helicopter. When the storm is over, perform an exterior inspection before resuming flight. (See figure 2–3, Chapter 3.) Clean out as much of the sand as possible that has sifted into the fuselage and the engine compartment, particularly the induction air and oil cooling systems. Check the rotor blades for damage and cooling systems. Check the rotor blades for damage and the flight control system for excessive friction.

4–17. CARGO SLING LOAD OPERATIONS.

4–18. When a cargo sling load hookup is to be made in a dusty or sandy area, make an approach at a slightly steeper angle than in the normal approach, terminating the approach slightly higher than the upper limit of ground cushion. This enables the pilot to orient over the load and start a vertical descent through the dust cloud created by the rotor wash as the helicopter descends into ground effect. The dust cloud is initially blown out and away from the helicopter and ground visibility can be maintained by looking straight down until hovering height is reached. As the dust cloud builds, obstructing visibility, adjust the landing light down and to the right. This creates a "ball of light" on the ground from which the height and position of the helicopter can be determined. Determine the approximate altitude desired for hookup operations and adjust the landing light at a hover prior to entering the hookup area. While the pilot's attention is centered on the "ball of light," the copilot will monitor all instruments and override the pilot on the twist-grip throttle to maintain the proper engine rpm. A light place on the ground, out in front of the helicopter, can be seen through the thin upper portion of the dust cloud as the load is brought to a hover, and establishes a point of reference for the takeoff out of the dust cloud.

4–19. APPROACH AND LANDING.

4–20. The landing approach should be relatively steep at low airspeed, with little forward speed just above the surface and landing, without hovering. Try to land on a hard surface or in an area where sand will not be blown on other helicopters. Restrict taxiing to a minimum.

4–21. POSTFLIGHT CHECK AND ENGINE SHUTDOWN.

4–22. Accomplish postflight check and engine shutdown, as soon as possible. (Refer to paragraph 2–91, Chapter 3.)

4–23. BEFORE LEAVING THE HELICOPTER.

4–24. Close all doors, windows, and vents. Be sure that all protective covers are installed and check the carburetor air filters for cleanliness, as they must not be left in a clogged condition. (Refer to paragraph 2–94, Chapter 3.)

SECTION V

TURBULENCE AND THUNDERSTORM OPERATION

5–1. TURBULENCE AND THUNDERSTORM PROCEDURE.

5–2. Turbulent areas should be avoided if possible. However, if inadvert turbulence is encountered, the helicopter should be flown at the recommended instrument airspeeds to improve its flying qualities and decrease the chance of blade stall. If severe turbulence is encountered, reduce airspeed to 50 knots and land if possible. In moderate turbulence, the work load of the pilot increases to the extent that he must concentrate solely on flying the helicopter. As a result, the pilot must disregard navigation, position reports, etc. Because of the helicopter's relatively slow speed and the difficulty of handling the helicopter in turbulence, thunderstorm flying is not recommended.

WARNING

If thunderstorms are encountered during flight, land and wait for the storm to pass. Moderate turbulence and restricted visibility can be expected.

CHAPTER 11
CREW DUTIES

Not Applicable

CHAPTER 12
WEIGHT AND BALANCE COMPUTATION
SECTION I
SCOPE

1–1. GENERAL.

1–2. This chapter provides appropriate information required for the computation of weight and balance for loading the CH-34 helicopter.

1–3. Sufficient data has been provided so that, knowing the basic weight and moment of the helicopter, any combination of weight and balance can be computed.

SECTION II

INTRODUCTION

2–1. PURPOSE.

2–2. The data to be inserted on weight and balance charts and forms are applicable only to the individual helicopter, the serial number of which appears on the title page of the booklet entitled WEIGHT AND BALANCE DATA supplied by the helicopter manufacturer and on the various forms and charts which remain with the helicopter in accordance with existing directives. The charts and forms referred to in this chapter may differ in nomenclature and arrangement from time to time, but the principle on which they are based will not change.

2–3. CHARTS AND FORMS.

2–4. The standard system of weight and balance control requires the use of several different charts and forms. They are identified as follows:

a. Chart C – Basic Weight and Balance Record, DD Form 365C.

b. Chart E – Loading Data, Charts and Graphs.

c. Form F – Weight and Balance Clearance Form F, DD Form 365F.

2–5. RESPONSIBILITY.

2–6. The helicopter manufacturer inserts all helicopter identifying data on the title page of the booklet entitled WEIGHT AND BALANCE DATA and on the various charts and forms. All charts, including one sample Weight and Balance Clearance Form F, if applicable, are completed at time of delivery. This record is the basic weight and balance data of the helicopter at delivery. All subsequent changes in weight and balance are compiled by the weight and balance technician.

2–7. HELICOPTER WEIGHINGS.

2–8. The helicopter must be weighed periodically as required by pertinent directives or when:

a. The pilot reports unsatisfactory flight characteristics (nose or tail heaviness).

b. Major modifications or repairs are made.

c. The basic weight data contained in the records are suspected to be in error.

2–9. The basic weight and cg location can only be as accurate as the scale equipment employed. The crewmember has available the current basic weight, moment/100, and index in the WEIGHT AND BALANCE DATA booklet.

SECTION III
DEFINITIONS

3–1. WEIGHT DEFINITIONS.

3–2. BASIC WEIGHT. The basic weight of a helicopter is that weight which includes all fixed operating equipment and trapped fuel and oil, to which it is only necessary to add variable or expendable load items for various missions.

Note

The basic weight of a helicopter varies with structural modifications and changes in fixed operating equipment. The term basic weight, when qualified with a word indicating the type mission such as Basic Weight for Combat, Basic Weight for Ferry, etc, may be used in conjunction with directives stating what equipment shall be for these missions. For example, extra fuel tanks and various items of equipment installed for long range ferry flights which are not normally carried on combat missions will be included in Basic Weight for Ferry but not in Basic Weight for Combat.

3–3. OPERATING WEIGHT. The operating weight of a helicopter is the basic weight plus those variable items which remain substantially constant for the type mission. The items include oil, crew, crew's baggage, and emergency and extra equipment that may be required.

3–4. GROSS WEIGHT. The gross weight is the total weight of a helicopter and its contents.

a. The takeoff gross weight is the operating weight plus the variable and expendable load items which vary with the mission. These items include fuel, external fuel tanks (if to be disposed of during flight), etc.

b. The landing gross weight is the takeoff gross weight minus the expended load items.

3–5. BALANCE DEFINITIONS. (See figure 3–1.)

3–6. REFERENCE DATUM. The reference datum is an imaginary vertical plane, at or forward of, the nose of the helicopter from which all horizontal distances are measured for balance purposes.

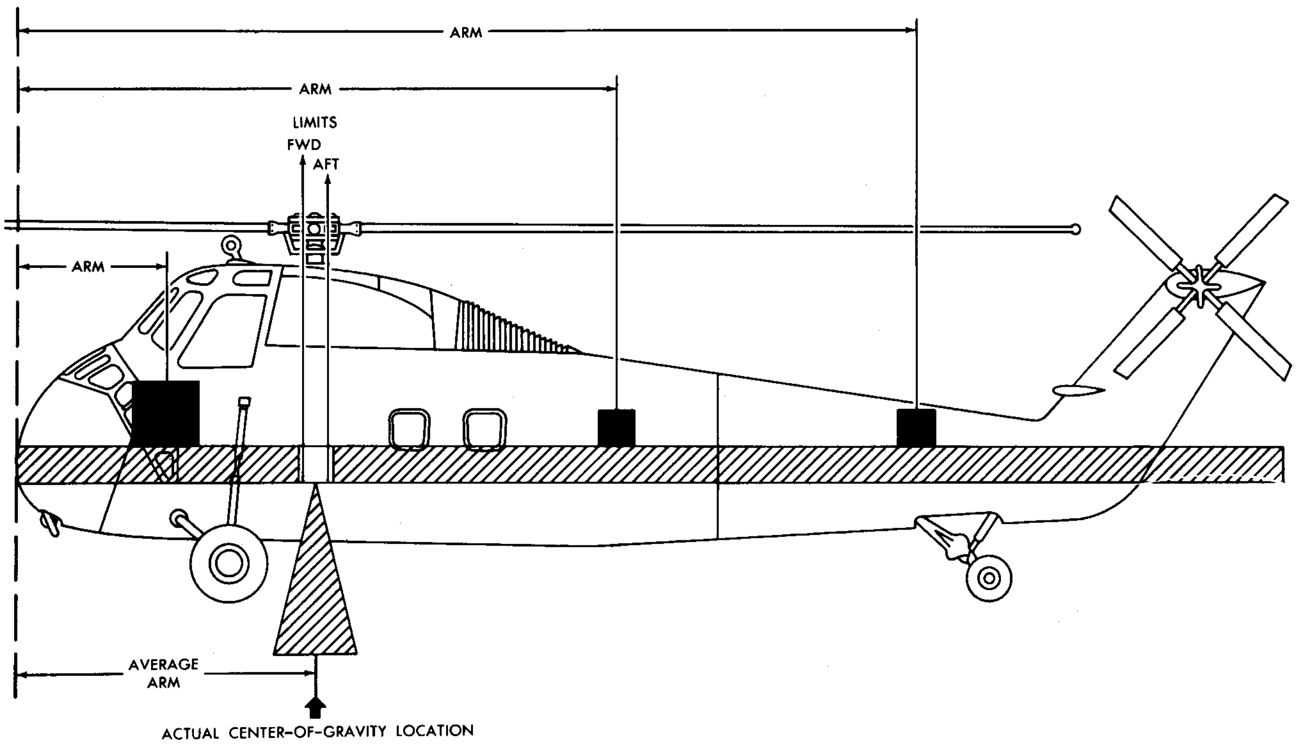


Figure 3–1. Reference Datum

Diagrams of each helicopter show this reference datum as balance station zero.

3–7. ARM. Arm, for balance purposes, is the horizontal distance in inches from the reference datum to the cg of the item. Arms may be determined from the helicopter diagram in Chart E.

3–8. MOMENT. Moment is the weight of an item multiplied by its arm. Moment divided by a constant is generally used to simplify balance calculations by reducing the number of digits. For this helicopter, inches and moment/100 have been used.

3–9. AVERAGE ARM. Average arm is the arm obtained by adding the weights and adding the moments of a number of items and dividing the total moment by the total weight.

3–10. BASIC MOMENT. Basic moment is the sum of the moments of all items making up the basic weight. When using data from an actual weighing of a helicopter, the basic moment is the total moment of the basic helicopter with respect to the reference datum.

3–11. CENTER-OF-GRAVITY (CG). Center-of-gravity is the point about which a helicopter would balance if suspended. Its distance from the reference datum is found by dividing the total moment by the gross weight of the helicopter.

3–12. CG LIMITS. CG limits are the extremes of movement which the cg can have without making the helicopter unsafe to fly. The cg of the loaded helicopter must be within these limits at takeoff, in the air, and on landing. In some cases, separate takeoff and landing limits may be specified.

SECTION IV

CHART EXPLANATIONS, CHART C AND E

4-1. CHART C-BASIC WEIGHT AND BALANCE RECORD. (See figure 4-1.)

4-2. Chart C is a continuous history of the basic weight and moment resulting from structural and equipment changes in service. At all times, the last weight and moment/100 entry is considered the current weight and balance status of the basic helicopter.

4-3. CHART E-LOADING DATA. (See figure 4-2.)

4-4. The loading data in Chart E is intended to provide information necessary to work a loading problem for the helicopter. From the loading graphs or tables, weight and moment/100 are obtained for all variable load items and are added arithmetically to the current basic weight and moment/100 (from Chart C) to obtain the gross weight and moment. The cg of the loaded helicopter is represented by a moment figure in the center-of-gravity table. If the helicopter is loaded within the forward and aft cg limits, the moment figure will fall numerically between the limiting moments. The effect on the cg of the expenditure in flight of such items as fuel may be checked by subtracting the weights and moments of such items from the takeoff gross weight and moment and checking the new moment with the center-of-gravity table. This check should be made to determine whether the cg will remain within limits during the entire flight.

CHART C — BASIC WEIGHT AND BALANCE RECORD

(Continuous History of Changes in Structure or Equipment Affecting Weight and Balance)

For Use in T.O. 1-1B-40 & AN 01-1B-40

AIRPLANE MODEL H-34A (SAMPLE ONLY) | SERIAL NO. | PAGE NO.

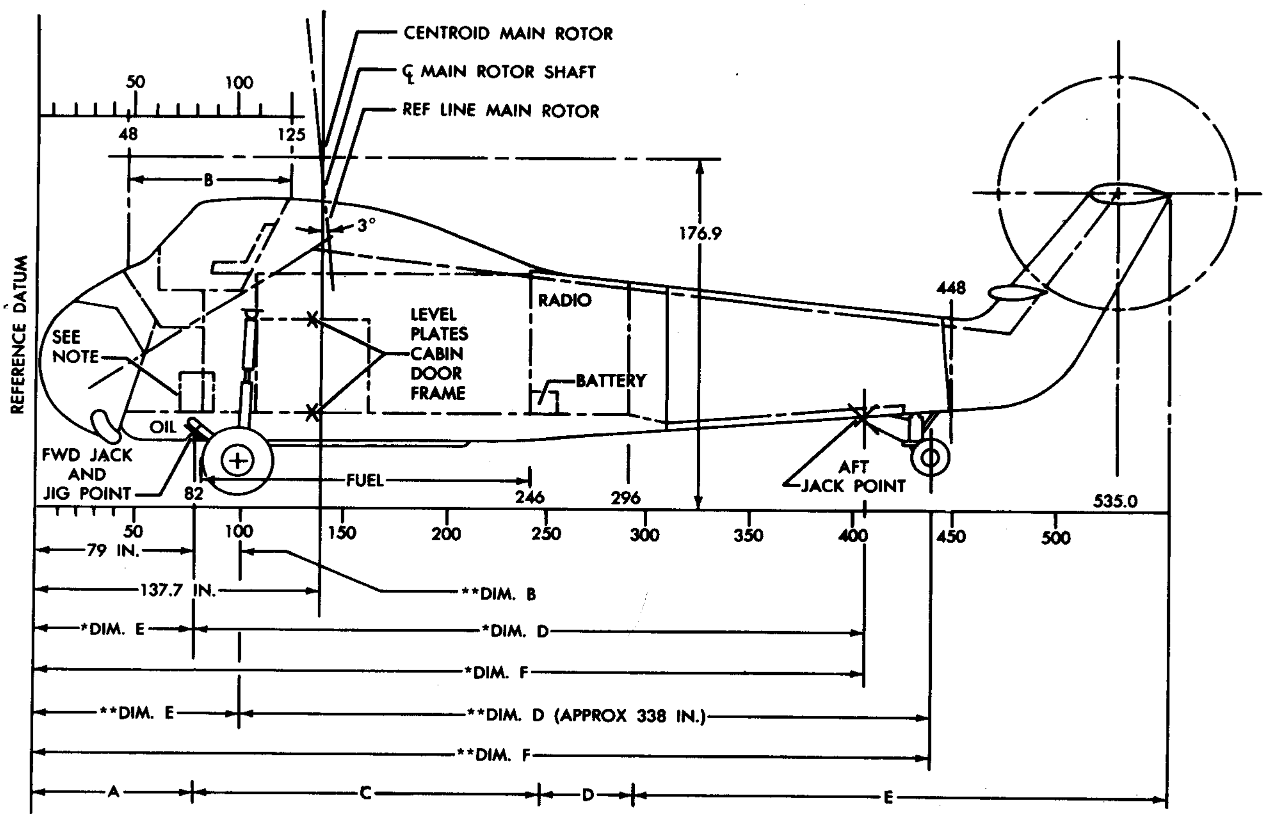
DATE	ITEM NO.		DESCRIPTION OF ARTICLE OR MODIFICATION	WEIGHT CHANGE						RUNNING TOTAL BASIC AIRPLANE		
				ADDED (+)			REMOVED (−)					
	IN	OUT		WEIGHT	ARM	MOMENT[1] 100	WEIGHT	ARM	MOMENT[1] 100	WEIGHT	MOMENT[1] 100	INDEX[2]
			BASIC HELICOPTER AS									
			DELIVERED									

SAMPLE

[1]Enter constant used below line. [2]Balance computer index.

DD FORM 1 SEPT 54 365C Previous editions of this form may be used until stocks are exhausted.

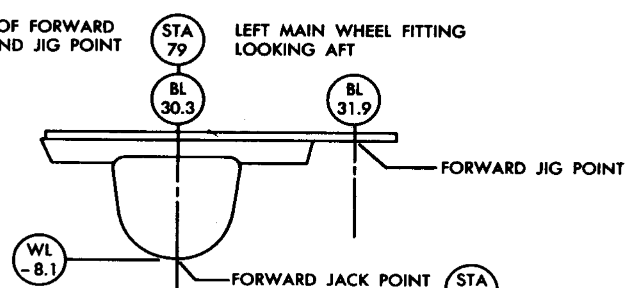
Figure 4–1. Chart C – Basic Weight and Balance Record

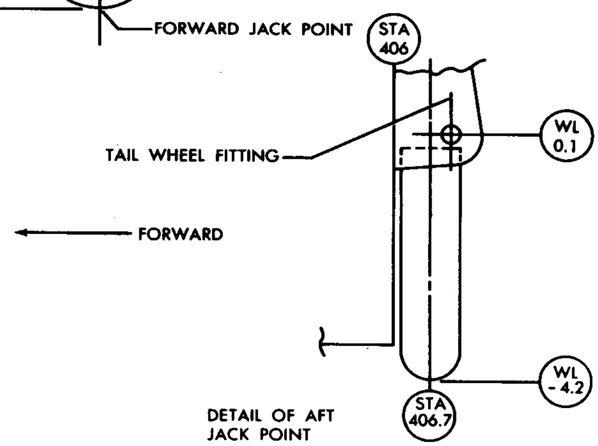


NOTE:

1. IT IS ADVISABLE TO WEIGH ON JACK POINTS BECAUSE OF EASE IN LEVELING.
2. USE PLUMB BOB SUSPENDED FROM TOP LEVEL PLATE (STA 139.5 ON UPPER CABIN DOOR FRAME) FOR CHECKING THE LEVELING OF THE AIRCRAFT DURING WEIGHING.
3. **WHEN WEIGHING ON WHEELS, POSITION MAIN WHEELS FOR FORWARD ROLLING AND MAIN OLEO STRUTS FOR STATIC LOADING. IF FLAT SCALE IS NOT AVAILABLE FOR TAIL WHEEL WEIGHING, THE TAIL SECTION MUST BE RAISED BY JACK OR HOIST AND SLING AND SCALE MOVED UNDER WHEEL. AFTER LEVELING, MEASURE **B AND **D. USING THESE ACTUAL DIMENSIONS AND LOCATION OF JIG POINT, DETERMINE **DIM. E AND **DIM. F. FOR CHECKING PURPOSES FOR THIS CONDITION THE DIMENSIONS FOR E AND F ARE APPROXIMATELY:
   DATUM LINE TO ℄ OF FORWARD WHEELS **DIM. E = 101 IN. APPROX
   DATUM LINE TO ℄ OF AFT WHEEL **DIM F = 439 IN. APPROX
4. RELOCATION OF BATTERY AND INVERTERS EFFECTIVE ON HELICOPTERS SERIAL NO. 56-4313 AND SUBSEQUENT, AND MODEL CH-34C.
5. MOMENT/100 IS USED IN LIEU OF MOMENT/1000.

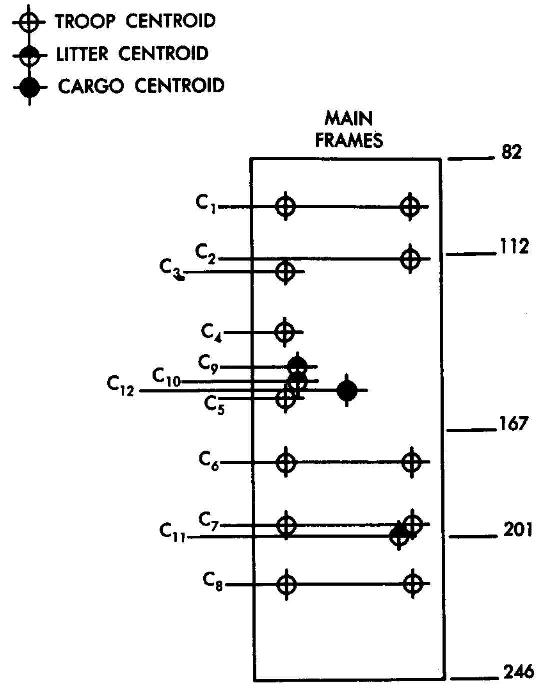
DETAIL OF FORWARD JACK AND JIG POINT





DETAIL OF AFT JACK POINT

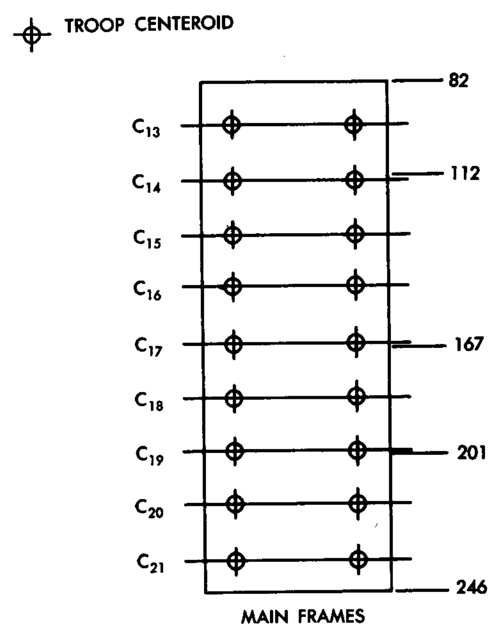
Figure 4–2. Chart E – Loading Data (Sheet 1 of 10)



COMPARTMENT LOADING DATA

COMPT	INCHES FROM REFERENCE DATUM		WEIGHT (POUNDS)
	CENTROID	COMPT LIMITS	
C		82 – 246	
C_1	95.9		480
C_2	112.2		240
C_3	115.6		240
C_4	135.1		240
C_5	155.6		240
C_6	176.1		480
C_7	195.5		480
C_8	214.8		480
C_9	147.0		750
C_{10}	150.0		250
C_{11}	199.0		1000
C_{12}	154.0		5000

NOTE: MOMENT/100 IS USED IN LIEU OF MOMENT/1000.



COMPARTMENT LOADING DATA

COMPT	INCHES FROM REFERENCE DATUM		WEIGHT (POUNDS)
	CENTROID	COMPT LIMITS	
C		82 – 246	
C_{13}	95.2		480
C_{14}	112.7		480
C_{15}	130.2		480
C_{16}	147.7		480
C_{17}	165.2		480
C_{18}	182.7		480
C_{19}	200.2		480
C_{20}	217.7		480
C_{21}	235.2		480

NOTE: MOMENT/100 IS USED IN LIEU OF MOMENT /1000

Figure 4–2. Chart E – Loading Data (Sheet 2 of 10)

FUEL				
		FORWARD TANK	CENTER TANK	AFT TANK
	BLADDER TYPE CELLS		CAP. 70.7 GAL	CAP. 92.3 GAL
GAL	SELF-SEALING CELLS	CAP. 100 GAL		
	WEIGHT (POUNDS)	ARM = 115.9 MOMENT/100	ARM = 183.7 MOMENT/100	ARM = 223.1 MOMENT/100
0	0	0	0	0
5	30	35	55	67
10	60	70	110	134
15	90	104	165	201
20	120	139	220	268
25	150	174	276	335
30	180	209	331	402
35	210	243	386	469
40	240	278	441	535
45	270	313	496	602
50	300	348	551	669
55	330	382	606	736
60	360	417	661	803
65	390	452	716	870
70	420	487	772	937
70.7	*424		*779	
75	450	522		1004
80	480	556		1071
85	510	591		1138
90	540	626		1205
92.3	*554			*1236
95	570	661		
100	*600	*695		

NOTE: 1. Approximate weight and moment for full fuel tank under standard conditions (60°F) based on 6.0 per gal is indicated by an asterisk. (*)

CAUTION

This helicopter is equipped with capacitor type fuel quanity gages which are calibrated in pounds. Aircraft fuel varies in weight per gallon, dependent upon specific gravity and temperature of fuel, therefore, notation FULL does not appear on instrument dial and pilot should anticipate variations in instrument readings when tanks are full.

2. Moment/100 is used in lieu of Moment/1000.

OIL					
CAPACITY=10.5 GALLONS ARM=64.0 IN.					
US GAL	WEIGHT (POUNDS)	MOMENT/100	US GAL	WEIGHT (POUNDS)	MOMENT/100
1	7.5	5	7	52.5	34
2	15.0	10	7.6	57.0	36
3	22.5	14	8	60.0	38
4	30.0	19	9	67.5	43
5	37.5	24	10	75.0	48
6	45.0	29	10.5	78.8	50

NOTE: Moment/100 is used in lieu of Moment/1000.

Figure 4–2. Chart E – Loading Data (Sheet 3 of 10)

TROOP COMPARTMENTS

COMPARTMENT-C	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8
ARM	95.9	112.2	115.6	135.1	155.6	176.1	195.5	214.8
WEIGHT (POUNDS)	MOMENT/100 IS USED FOR TROOP ARMS NOTED							
25	24	28	29	34	39	44	49	54
50	48	56	58	68	78	88	98	107
75	72	84	87	101	117	132	147	161
100	96	112	116	135	156	176	196	215
125	120	140	145	169	195	220	244	269
150	144	168	173	203	234	264	293	322
175	168	196	202	236	272	308	342	376
200	192	224	231	270	311	352	391	430
225	216	252	260	304	350	396	440	483
240	230	269	277	324	374	422	469	516
250	240					440	489	537
275	264					484	538	591
300	288					528	586	644
325	312					572	635	698
350	336					616	684	752
375	360					660	733	806
400	384					704	782	859
425	408					748	831	913
450	432					792	880	967
475	456					836	929	1020
480	461					845	938	1031

NOTE: Moment/100 is used in lieu of Moment/1000.

TROOP COMPARTMENTS (FOR 18-MAN TROOP SEATING ONLY)

COMPARTMENT-C	C_{13}	C_{14}	C_{15}	C_{16}	C_{17}	C_{18}	C_{19}	C_{20}	C_{21}
ARM	95.2	112.7	130.2	147.7	165.2	182.7	200.2	217.7	235.2
WEIGHT (POUNDS)	MOMENT/100 IS USED FOR TROOP ARMS NOTED								
25	24	28	33	37	41	46	50	54	59
50	48	56	65	74	83	91	100	159	118
75	71	85	98	111	124	137	150	163	176
100	95	113	130	148	165	183	200	218	235
125	119	141	163	185	207	228	250	272	294
150	143	169	195	222	248	274	300	327	353
175	167	197	228	258	289	320	350	381	412
200	190	225	260	295	330	365	400	435	470
225	214	254	293	332	372	411	450	490	529
240	228	270	312	354	396	438	480	522	564
250	238	282	326	369	413	457	501	544	588
275	262	310	358	406	454	502	551	599	647
300	286	338	391	443	496	548	601	653	706
325	309	366	423	480	537	594	651	708	764
350	333	394	456	517	578	639	701	762	823
375	357	423	488	554	620	685	751	816	882
400	381	451	521	591	661	731	801	871	941
425	405	479	553	628	702	776	851	925	1000
450	428	507	586	665	743	822	901	980	1058
475	452	535	618	702	785	868	951	1034	1117
480	457	541	625	709	793	877	961	1045	1129

NOTE: Moment/100 is used in lieu of Moment/1000.

Figure 4–2. Chart E – Loading Data (Sheet 4 of 10)

LITTER PATIENT

COMPART-MENT-C	C_9	C_{10}	C_{11}
ARM	147.0	150.0	199.0
WEIGHT (POUNDS)	MOMENT/100		
	LEFT HAND		RIGHT
250	368	375	498
500	735		995
750	1103		1491
1000			1990

Includes 20 pounds for each litter.
NOTE: Moment/100 is used in lieu of Moment/1000.

CARGO COMPARTMENTS

COMPARTMENTS — C			
WEIGHT (POUNDS)	ARM = 154.0 MOMENT/100	WEIGHT (POUNDS)	ARM = 154.0 MOMENT/100
20	31	2600	4004
40	62	2700	4158
60	92	2800	4312
80	123	2900	4466
100	154	3000	4620
200	308	3100	4774
300	462	3200	4928
400	616	3300	5082
500	770	3400	5236
600	924	3500	5390
700	1078	3600	5544
800	1232	3700	5698
900	1386	3800	5852
1000	1540	3900	6006
1100	1694	4000	6160
1200	1848	4100	6314
1300	2002	4200	6468
1400	2156	4300	6622
1500	2310	4400	6776
1600	2464	4500	6930
1700	2618	4600	7084
1800	2772	4700	7238
1900	2926	4800	7392
2000	3080	4900	7546
2100	3234	5000	7700
2200	3388		
2300	3542		
2400	3696		
2500	3850		

NOTE: Moment/100 is used in lieu of Moment/1000.

EXTERNAL CARGO (SLING)

WEIGHT (POUNDS)	ARM = 139.5 MOMENT/100	WEIGHT (POUNDS)	ARM = 139.5 MOMENT/100
25	35	2600	3627
50	70	2700	3767
75	105	2800	3906
100	140	2900	4046
200	279	3000	4185
300	419	3100	4325
400	558	3200	4464
500	698	3300	4604
600	837	3400	4743
700	977	3500	4883
800	1116	3600	5022
900	1255	3700	5162
1000	1395	3800	5301
1100	1535	3900	5441
1200	1674	4000	5580
1300	1814	4100	5720
1400	1953	4200	5859
1500	2093	4300	5999
1600	2232	4400	6138
1700	2372	4500	6278
1800	2511	4600	6417
1900	2651	4700	6557
2000	2790	4800	6696
2100	2930	4900	6836
2200	3069	5000	6975
2300	3209		
2400	3348		
2500	3488		

NOTE: Moment/100 is used in lieu of Moment/1000.

EXTERNAL HOIST

WEIGHT (POUNDS)	ARM = 139.5 MOMENT/100	WEIGHT (POUNDS)	ARM = 139.5 MOMENT/100
25	35	325	453
50	70	350	488
75	105	375	523
100	140	400	558
125	174	425	593
150	209	450	628
175	244	475	663
200	279	500	698
225	314	525	732
250	349	550	767
275	384	575	802
300	419	600	837

NOTE: Moment/100 is used in lieu of Moment/1000.

Figure 4–2. Chart E – Loading Data (Sheet 5 of 10)

CREW

WEIGHT (POUNDS)	PILOT AND COPILOT ARM = 92.6 IN. MOMENT/100	WEIGHT (POUNDS)	PILOT AND COPILOT ARM = 92.6 IN. MOMENT/100
140	130	380	352
160	148	400	370
180	167	420	389
200	185	440	407
220	204	460	426
240	222	480	444
260	241	500	463
280	259		
300	278		
320	296		
340	315		
360	333		

NOTE: 1. Use actual crew weight and allow 20 pounds each for parachute if carried.

2. Moment/100 is used in lieu of Moment/1000.

CREW MOVEMENT – MOMENT/100

COMPARTMENT ARM	B 92.6	C_1 95.0	C_2 112.2	C_3 115.6	C_4 135.1	C_5 155.6	C_6 176.1	C_7 195.5	C_8 214.8
C_8	244	238	205	198	159	118	77	39	
C_7	206	199	167	160	121	80	39		
C_6	167	160	128	121	82	41			
C_5	126	119	87	80	41				
C_4	85	78	46	39					
C_3	46	39	7						
C_2	39	33							
C_1	7								

NOTE: 1. Add Moment/100 for troop movement aft (Plus (+) sign). Subtract Moment/100 for troop movement fwd (Minus (–) sign). Based on 200 pounds per man, including 20 pounds for crewmember's parachute.

EXAMPLE: Move one man from B compartment to C3 compartment. Add 46 to total Moment/100. Move one man from C5 compartment to C2 compartment. Subtract 87 from total Moment/100.

2. Moment/100 is used in lieu of Moment/1000.

COMPARTMENT ARM	B 92.6	C_{13} 95.2	C_{14} 112.7	C_{15} 130.2	C_{16} 147.7	C_{17} 165.2	C_{18} 182.7	C_{19} 200.2	C_{20} 217.7	C_{21} 235.2
C_{21}	285	280	245	210	175	140	105	70	35	
C_{20}	250	245	210	175	140	105	70	35		
C_{19}	215	210	175	140	105	70	35			
C_{18}	180	175	140	105	70	35				
C_{17}	145	140	105	70	35					
C_{16}	110	105	70	35						
C_{15}	75	70	35							
C_{14}	40	35								
C_{13}	5									

NOTE: 1. Add Moment/100 for troop movement aft (Plus (+) sign). Subtract Moment/100 for troop movement fwd (Minus (–) sign). Based on 200 pounds per man, including 20 pounds for crewmember's parachute.

EXAMPLE: Move one man from C13 compartment to C16 compartment. Add 105 to total Moment/100. Move one man from C19 compartment to C15 compartment. Subtract 140 from total Moment/100.

2. Moment/100 is used in lieu of Moment/1000.

Figure 4–2. Chart E – Loading Data (Sheet 6 of 10)

CENTER-OF-GRAVITY

GROSS WEIGHT (POUNDS)	FWD LIMIT STA 130.7	STA 133.4	STA 136.1	STA 138.8	STA 141.5	STA 144.2	AFT LIMIT STA 146.7
7500	9803	10005	10208	10410	10613	10815	11003
7550	9868	10072	10276	10479	10683	10887	11076
7600	9933	10138	10344	10549	10754	10959	11149
7650	9999	10205	10412	10618	10825	11031	11223
7700	10064	10272	10480	10688	10896	11103	11296
7750	10129	10339	10548	10757	10966	11176	11369
7800	10195	10405	10616	10826	11037	11248	11443
7850	10260	10472	10684	10896	11108	11320	11516
7900	10325	10539	10752	10965	11179	11392	11589
7950	10391	10605	10820	11035	11249	11464	11663
8000	10456	10672	10888	11104	11320	11536	11736
8050	10521	10739	10956	11173	11391	11608	11809
8100	10588	10805	11024	11243	11462	11680	11883
8150	10652	10872	11092	11312	11532	11723	11956
8200	10717	10939	11160	11382	11603	11824	12029
8250	10783	11006	11228	11451	11674	11897	12103
8300	10848	11072	11296	11520	11745	11969	12176
8350	10913	11139	11364	11590	11815	12041	12249
8400	10979	11206	11432	11659	11886	12113	12323
8450	11044	11272	11501	11729	11957	12185	12396
8500	11109	11339	11569	11798	12028	12257	12470
8550	11175	11406	11637	11867	12098	12329	12543
8600	11240	11472	11705	11937	12169	12401	12616
8650	11305	11539	11773	12006	12240	12473	12690
8700	11371	11606	11841	12076	12311	12545	12763
8750	11436	11673	11909	12145	12381	12618	12836
8800	11502	11739	11977	12214	12452	12690	12910
8850	11567	11806	12045	12284	12523	12762	12983
8900	11632	11873	12113	12353	12594	12834	13056
8950	11698	11939	12181	12423	12664	12906	13130
9000	11763	12006	12249	12492	12735	12978	13203
9050	11828	12073	12317	12561	12806	13050	13276
9100	11894	12139	12385	12631	12877	13122	13350
9150	11959	12206	12453	12700	12947	13194	13423
9200	12024	12273	12521	12770	13018	13266	13496
9250	12090	12340	12589	12839	13089	13339	13570
9300	12155	12406	12657	12908	13160	13411	13643
9350	12220	12473	12725	12978	13230	13483	13716
9400	12286	12540	12793	13047	13301	13555	13790
9450	12351	12606	12861	13117	13372	13627	13863
9500	12417	12673	12930	13186	13443	13699	13937
9550	12482	12740	12998	13255	13513	13771	14010
9600	12547	12806	13066	13325	13584	13843	14083
9650	12613	12873	13134	13394	13655	13915	14157
9700	12678	12940	13201	13464	13726	13987	14230
9750	12743	13007	13270	13533	13796	14060	14303
9800	12809	13073	13338	13602	13867	14132	14377
9850	12874	13140	13406	13672	13938	14204	14450
9900	12939	13206	13474	13741	14009	14276	14523
9950	13005	13273	13542	13811	14079	14348	14597
10000	13070	13340	13610	13880	14150	14420	14670
10050	13135	13407	13678	13949	14221	14492	14743
10100	13200	13473	13746	14019	14292	14564	14817
10150	13266	13540	13814	14088	14362	14636	14890
10200	13331	13607	13882	14158	14433	14708	14963

NOTE: Moment/100 is used in lieu of Moment/1000.

Figure 4–2. Chart E – Loading Data (Sheet 7 of 10)

CENTER-OF-GRAVITY (Cont)

GROSS WEIGHT (POUNDS)	FWD LIMIT STA 130.7	STA 133.4	STA 136.1	STA 138.8	STA 141.5	STA 144.2	AFT LIMIT STA 146.7
10250	13397	13674	13950	14227	14504	14781	15037
10300	13462	13740	14018	14296	14575	14853	15110
10350	13527	13807	14086	14366	14645	14925	15183
10400	13593	13874	14154	14435	14716	14997	15257
10450	13658	13940	14222	14505	14787	15069	15330
10500	13724	14007	14290	14574	14858	15141	15404
10550	13789	14074	14358	14643	14928	15213	15477
10600	13854	14140	14427	14713	14999	15285	15550
10650	13920	14207	14495	14782	15070	15357	15624
10700	13985	14274	14563	14852	15141	15429	15697
10750	14050	14341	14631	14921	15211	15502	15770
10800	14116	14407	14699	14990	15282	15574	15844
10850	14181	14474	14767	15060	15353	15646	15917
10900	14246	14541	14835	15129	15424	15718	15990
10950	14312	14607	14903	15199	15494	15790	16064
11000	14377	14674	14971	15268	15565	15862	16137
11050	14442	14741	15039	15337	15636	15934	16210
11100	14507	14807	15107	15407	15707	16006	16284
11150	14573	14874	15175	15476	15777	16078	16357
11200	14638	14941	15243	15546	15848	16150	16430
11250	14704	15008	15311	15615	15919	16223	16504
11300	14769	15074	15379	15684	15990	16295	16577
11350	14834	15141	15447	15754	16060	16367	16650
11400	14900	15208	15515	15823	16131	16439	16724
11450	14965	15274	15583	15893	16202	16511	16797
11500	15031	15341	15652	15962	16273	16583	16871
11550	15096	15408	15720	16031	16343	16655	16944
11600	15161	15474	15788	16101	16414	16727	17017
11650	15227	15541	15856	16170	16485	16799	17091
11700	15292	15608	15924	16240	16556	16871	17164
11750	15357	15675	15992	16309	16626	16944	17237
11800	15423	15741	16060	16378	16697	17016	17310
11850	15488	15808	16128	16448	16768	17088	17384
11900	15553	15875	16196	16517	16839	17160	17457
11950	15619	15941	16264	16587	16909	17232	17531
12000	15684	16008	16332	16656	16980	17304	17604
12050	15749	16075	16400	16725	17051	17376	17677
12100	15815	16141	16468	16795	17122	17448	17751
12150	15880	16208	16536	16864	17192	17520	17824
12200	15945	16275	16603	16934	17263	17592	17897
12250	16011	16342	16672	17003	17334	17665	17971
12300	16076	16408	16740	17072	17405	17737	18044
12350	16141	16475	16808	17142	17475	17809	18117
12400	16207	16542	16876	17211	17546	17881	18191
12450	16272	16608	16944	17281	17617	17953	18264
12500	16338	16675	17013	17350	17688	18025	18338
12550	16403	16742	17081	17419	17758	18097	18411
12600	16468	16808	17149	17489	17829	18169	18484
12650	16534	16875	17217	17558	17900	18241	18558
12700	16599	16942	17285	17628	17971	18313	18631
12750	16664	17009	17353	17697	18041	18386	18704
12800	16730	17075	17421	17766	18112	18478	18778
12850	16795	17142	17489	17836	18183	18530	18851
12900	16860	17209	17557	17905	18254	18602	18924
12950	16926	17275	17625	17975	18324	18674	18998
13000	16991	17342	17693	18044	18395	18746	19071
13050	17056	17409	17761	18113	18466	18818	19144

NOTE: Moment/100 is used in lieu of Moment/1000.

Figure 4–2. Chart E – Loading Data (Sheet 8 of 10)

CENTER-OF-GRAVITY (Cont)

GROSS WEIGHT (POUNDS)	FWD LIMIT STA 130.7	STA 133.4	STA 136.1	STA 138.8	STA 141.5	STA 144.2	AFT LIMIT STA 146.7
13100	17112	17475	17829	18183	18537	18890	19218
13150	17187	17542	17897	18252	18607	18962	19291
13200	17252	17609	17965	18322	18678	19034	19364
13250	17318	17676	18033	18391	18749	19107	19438
13300	17383	17742	18101	18460	18820	19179	19511
13350	17448	17809	18169	18530	18890	19251	19584
13400	17514	17876	18237	18599	18961	19323	19658
13450	17579	17942	18305	18669	19032	19395	19731
13500	17644	18009	18374	18738	19102	19467	19804
13550	17710	18076	18442	18807	19173	19539	19878
13600	17775	18142	18510	18877	19244	19611	19951
13650	17840	18209	18578	18946	19315	19683	20025
13700	17906	18276	18646	19016	19386	19755	20098
13750	17971	18342	18714	19085	19456	19828	20171
13800	18037	18409	18782	19154	19527	19900	20245
13850	18102	18476	18850	19224	19598	19972	20318
13900	18167	18543	18918	19293	19668	20044	20391
13950	18233	18609	18986	19363	19739	20116	20465
14000	18298	18676	19054	19432	19810	20188	20538

NOTE: 1. The center-of-gravity limits given above are recommended design limits.

Recommended maximum takeoff gross weight 13300 pounds
Recommended maximum landing gross weight 13300 pounds

2. Moment/100 is used in lieu of Moment/1000.

MISCELLANEOUS DATA

Jig Point Locations — Sta 79 and Sta 406.7

Most Forward CG 130.7 inches — Most Aft CG 146.7 inches — Range 16 inches

Basic Weight (approx) 7545 pounds

Wheel Base (approx) 338 inches

Tread Main Wheel (approx) 144 inches

Distance From Reference Datum To:

Center Line Main Wheels	101 inches (approx)
Center Line Aft Wheel	439 inches (approx)
Forward Jack Pads	79 inches
Rear Jack Pads	406.7 inches
Pilot	92.6 inches

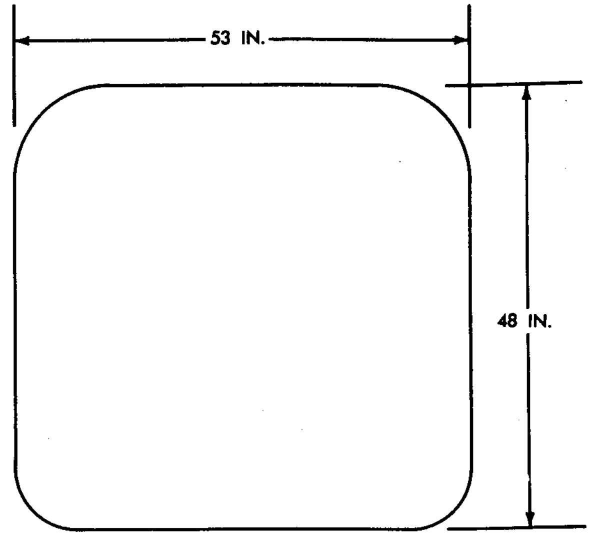
NOTE: Moment/100 is used in lieu of Moment/1000.

Figure 4–2. Chart E – Loading Data (Sheet 9 of 10)

WIDTH IN INCHES

LENGTH IN INCHES

	5	10	15	20	25	30	35	49	45	48
55	42	42	42	42	24	42	42	40	40	38
60	42	42	42	42	42	42	42	40	38	
65	42	42	42	42	42	42	40	38		
70	42	42	42	42	42	42	40			
75	42	42	42	42	42	40	38			
80	42	42	42	42	42	40				
85	42	42	42	42	40	40				
90	42	42	42	42	40	38				
95	42	42	42	40	40					
100	42	42	42	40	40					
105	40	40	40	40	38					
110	40	40	40	40	38					
115	40	40	40	40						
120	40	40	40	38						
125	38	38	38	38						
130	38	38	38							
135	38									



SIDE CARGO DOOR — MAXIMUM HEIGHTS

NOTE: MOMENT/100 IS USED IN LIEU OF MOMENT/1000.

Figure 4–2. Chart E – Loading Data (Sheet 10 of 10)

SECTION V

WEIGHT AND BALANCE CLEARANCE FORM F, DD FORM 365F

5-1. DESCRIPTION.

5-2. Form F is the summary of the actual disposition of load. Form F records the balance status step by step and serves as a work sheet on which the weight and balance technician records calculations. The weight and balance technician also records any corrections that must be made to insure that the helicopter will be within weight and cg limits. It is necessary to accomplish Form F prior to flight when a helicopter is loaded in a manner for which no previous valid Form F is available.

5-3. Form F is furnished in expendable pads or as separate sheets which can be replaced when exhausted. An original and carbon are prepared for each loading. The original sheets, carrying the signature of responsibility, can be removed to serve as certificates of proper weight and balance as required by existing clearance directives. The duplicate copy must remain in the helicopter for the duration of the flight. On a cross-country flight this form aids the weight and balance technician at refueling bases and stopover stations. There are two versions of this form: TRANSPORT and TACTICAL. These forms were designed to provide for the respective loading arrangement of these two types of aircraft. The general use and fulfillment of either version is the same, although specific instructions for filling out only one version are given herein.

5-4. USE.

5-5. TRANSPORT AIRCRAFT. (See figure 5-1.)

a. Insert the necessary identifying information at the top of the form. In the blank spaces of the LIMITATIONS table, enter the gross weight and cg restrictions obtained from the latest applicable technical manuals.

b. Ref 1. Enter the helicopter basic weight and index of moment/100. Obtain these figures from the last entry on the Chart C—Basic Weight and Balance Record.

Note

If a balance computer is used in loading helicopter, enter opposite Ref 1 index figure obtained from Chart C and use index figures throughout form. Enter plate number of computer (located on end of base) under REMARKS. If Chart E is used instead of a balance computer, enter moment/100 values throughout form.

c. Ref 2. Enter amount and weight of oil.

d. Ref 3. Enter number and weight of crew. Use actual crew weights if available.

e. Ref 4. Enter weight of crew's baggage.

f. Ref 5. Enter weight of steward's equipment.

g. Ref 6. Enter weight of emergency equipment.

h. Ref 7. Enter weight of any extra equipment.

i. Ref 8. Enter sum of the weights for Ref 1 through Ref 7 inclusive to obtain operating weight.

j. Ref 9. Enter number of gallons and weight of takeoff fuel. Weight of fuel used in warmup and taxi should not be included.

Note

List under REMARKS fuel tanks concerned and amount of fuel in each tank. If external or bomb bay fuel is carried, make appropriate entries to that effect in space provided.

k. Ref 10. Not applicable to the CH-34 helicopter.

l. Ref 11. Enter sum of weights for Ref 8 through Ref 10 inclusive to obtain total airplane weight.

m. Determine ALLOWABLE LOAD based on takeoff, landing, or limiting wing fuel restrictions by use of LIMITATIONS table in upper left-hand corner of form as follows:

(1) Enter ALLOWABLE GROSS WEIGHT for TAKEOFF and LANDING. For aircraft which have a gross weight restriction above which all weight must be fuel in wings (eg, a zero wing fuel gross weight), enter ALLOWABLE GROSS WEIGHT for

WEIGHT AND BALANCE CLEARANCE FORM F

TRANSPORT

(USE REVERSE FOR TACTICAL MISSIONS)

Cross Reference RAF Form 2870 RCAF Form F. 115 C 50M 5-51 (6797)

FOR USE IN T.O. 1-1B-40 & AN 01-1B-40

DATE	AIRPLANE TYPE	FROM	HOME STATION
11 Feb. 63	CH-34	Fort X	Fort X
MISSION/TRIP/FLIGHT/NO.	**SERIAL NO.**	**TO**	**PILOT**
Ferry	00-0000	Fort Y	Doe J.

CONDITION	LIMITATIONS TAKEOFF	LIMITATIONS LANDING	LIMITING WING FUEL
²ALLOWABLE GROSS WEIGHT	13,000	13,000	
TOTAL AIRPLANE WEIGHT *(Ref. 11)*	9841		
OPERATING WEIGHT PLUS ESTIMATED LANDING FUEL WEIGHT		8763	
OPERATING WEIGHT *(Ref. 8)*			
ALLOWABLE LOAD *(Ref. 12) (use SMALLEST figure)*	3159	4237	
³PERMISSIBLE C. G. TAKEOFF	FROM 130.7	TO (146.7 IN.)	
⁴PERMISSIBLE C. G. LANDING	FROM 130.7	TO (146.7 IN.)	
⁵LANDING FUEL WEIGHT	500 lb		

REF	ITEM	WEIGHT	~~INDEX OR~~ MOM/ 100
1	BASIC AIRPLANE *(From Chart C)*	7784	109078
2	OIL (10.5 Gal.)	79	500
3	CREW *(No.)* 2	400	3700
4	CREW'S BAGGAGE		
5	STEWARD'S EQUIPMENT		
6	EMERGENCY EQUIPMENT		
7	EXTRA EQUIPMENT		
8	OPERATING WEIGHT	8263	113278
9	TAKEOFF FUEL (262 Gal.)	1578	27100
10	WATER INJ. FLUID (Gal.)		
11	TOTAL AIRPLANE WEIGHT	9841	140378

REMARKS

FUEL
FORWARD TANK
600 lb MOM/100 695.0
CENTER TANK
424 lb MOM/100 779.0

TOTAL FREIGHT	———
TOTAL MAIL	———
COMPUTER PLATE NUMBER *(If used)*	

¹*Enter constant used.*
²*Enter values from current applicable T.O.*
³*Applicable to gross weight (Ref. 15).*
⁴*Applicable to gross weight (Ref. 18).*
⁵*Ref. 9 minus Ref. 17.*

12 DISTRIBUTION OF ALLOWABLE LOAD (PAYLOAD)

COMPT	UPPER PASSENGERS NO.	UPPER PASSENGERS WEIGHT	UPPER CARGO	LOWER COMPT	LOWER PASSENGERS NO.	LOWER PASSENGERS WEIGHT	LOWER CARGO	WEIGHT	MOM/100
A				C-13	2	400		400	3810
B				C-14	2	400		400	4510
C				C-15	2	400		400	5210
D				C-16	2	400		400	5920
E				C-17	2	400		400	6610
F				C-18	2	400		400	7310
G				C-19	2	400		400	8010
H									
I									
J									
K									
L									
M									
N									
O									
P									
FWD BELLY									
AFT BELLY									

SAMPLE

CORRECTIONS *(Ref. 14)*

COMPT	ITEM	CHANGES (+ or −) WEIGHT	~~INDEX OR~~ MOM/100
Aft Tank	Fuel	-554	-1236.0
TOTAL WEIGHT REMOVED		-554	-1236.0
TOTAL WEIGHT ADDED		+	+
NET DIFFERENCE *(Ref. 14)*		-554	-1236.0

REF	ITEM	WEIGHT	MOM/100
13	TAKEOFF CONDITION *(Uncorrected)*	12641	181748
14	CORRECTIONS *(If required)* (−)	554	12360
15	TAKEOFF CONDITION *(Corrected)*	12087	169388
16	TAKEOFF C. G. IN % M. A. C. OR IN.	142.5	
17	LESS FUEL	524	8948
18	LESS AIR SUPPLY LOAD DROPPED		
19	MISC. VARIABLES		
20	ESTIMATED LANDING CONDITION	11563	160440
21	ESTIMATED LANDING C. G.	138.8	

COMPUTED BY John Doe SIGNATURE 1st LT US ARMY

WEIGHT AND BALANCE AUTHORITY Charles Smith SIGNATURE Capt US ARMY

PILOT John Doe SIGNATURE 1st LT US ARMY

DD FORM 1 SEPT 54 365F

16—67910-3 U.S. GOVERNMENT PRINTING OFFICE

NOTE.—THIS TRANSPORT CLEARANCE FORM HAS RESULTED FROM TRIPARTITE AGREEMENT AND NO FURTHER CHANGES MAY BE MADE TO IT WITHOUT PRIOR CONSIDERATION BY TRIPARTITE AUTHORITIES.

Figure 5-1. Weight and Balance Clearance Form F - Transport

LIMITING WING FUEL in last column of LIMITATIONS table.

(2) Enter TOTAL AIRPLANE WEIGHT (from Ref 11). Estimate fuel to be aboard at time of landing, and enter OPERATING WEIGHT (from Ref 8) and OPERATING WEIGHT PLUS ESTIMATED LANDING FUEL WEIGHT.

(3) Subtract above weights from respective allowable gross weights to obtain respective allowable loads. The smallest of these allowable loads is the ALLOWABLE LOAD and represents maximum amount of weight which may be distributed throughout helicopter in various compartments without exceeding limiting gross weights of helicopter.

n. Ref 12. Using same compartment letter designation as shown on back of balance computer or in figure 5–1, enter number and weight of passengers and weight of cargo (baggage, mail, etc). Enter total for each compartment in WEIGHT column. If desired for statistical purposes, TOTAL FREIGHT and TOTAL MAIL weights may also be listed in space provided under REMARKS.

WARNING

When helicopters are operated at gross weights approaching the critical area, the exact weight of each individual occupant plus equipment should be used. If weighing facilities are not available, or if the tactical situation dictates otherwise, loads will be computed as follows: Combat equipped soldiers, 240 lb per individual; Combat equipped paratroopers, 260 lb per individual; and crew and passengers with no equipment, use actual crew weights. Add 20 lb for each parachute carried. Maximum allowable weight in pilot and copilot position is 250 lb each.

Note

Sum of the compartment totals must not exceed ALLOWABLE LOAD determined in LIMITATIONS table.

o. Ref 13. Enter sum of Ref 11 and compartment totals under Ref 12 opposite TAKEOFF CONDITION (Uncorrected). Calculate and enter index or moment/100 for Ref 1 through Ref 13 inclusive.

p. Check weight figure, Ref 13, against ALLOWABLE GROSS WEIGHT TAKEOFF in LIMITATIONS table. Check index or moment/100 figure opposite Ref 13 by means of balance computer or Chart E, respectively, to ascertain that indicated cg is within allowable limits.

q. If changes in amount of distribution of load are required, indicate necessary adjustments by proper entries in CORRECTIONS table in lower left-hand corner of form. Enter a brief description of adjustment made in column marked ITEM. Add all weight and amount decreases and insert totals in space opposite TOTAL WEIGHT REMOVED. Add all weight and moment increases and insert the totals in space opposite TOTAL WEIGHT ADDED. Subtract smaller from larger of two totals and enter difference (with applicable + or - sign) opposite NET DIFFERENCE. If a balance computer is used, the revised index for each correction item rather than plus or minus index changes is entered. Transfer these NET DIFFERENCE figures to spaces opposite Ref 14.

r. Ref 15. Enter sum of, or difference between, Ref 13 and Ref 14. Recheck to assure that these figures do not exceed allowable limits.

s. Ref 16. By referring to center-of-gravity table in Chart E, or to cg grid on balance computer, determine takeoff cg position. Enter this figure in space provided opposite TAKEOFF C.G. IN % M.A.C. OR IN.

t. Ref 17. Estimate weight of fuel which may be expended before landing. Enter figures together with index or moment/100 in the spaces provided.

Note

Do not consider reserve fuel as expended when determining ESTIMATED LANDING CONDITION.

u. Ref 18. Enter weight of air supply load to be dropped before landing, with index or moment/100.

v. Ref 19. Enter weight of MISC. VARIABLES to be expended before landing, with index or moment/100; and enter shift of crew to landing positions, with index or moment/100 change due to crew movement. Explain under REMARKS, if necessary.

w. Ref 20. Enter differences in weights and index or moment/100 between Ref 15 and total of Ref 17, 18, and 19.

x. Ref 21. By again referring to center-of-gravity table on Chart E, or to cg grid on balance computer, determine estimated landing cg position. Enter this figure opposite ESTIMATED LANDING C.G.

y. Necessary signatures must appear at bottom of form.

5-6. SAMPLE PROBLEM.

5-7. COMPUTATION WITHOUT COMPUTER. (See figure 5-1.)

5-8. Calculate weight and balance conditions for takeoff and landing of the CH-34 which is to be loaded with the items listed below.

5-9. Given:

a. Basic Airplane Weight, 7784 lb.

b. Basic Airplane Moment, 10,907.8 moment/100.

c. Nonbasic items to be loaded:

Item	Arm (in.)	Weight (lb)
Oil	64.0	79
Crew		
Pilot	92.6	200
Copilot	92.6	200
Fuel		
Forward (100 gal)	115.9	600
Center (70.7 gal)	183.7	424
Aft (92.3 gal)	223.1	554
Passengers		
2, Compartment C-13	95.2	400
2, Compartment C-14	112.7	400
2, Compartment C-15	130.2	400
2, Compartment C-16	147.7	400
2, Compartment C-17	165.2	400
2, Compartment C-18	182.7	400
2, Compartment C-19	200.2	400

5-10. Assume that the only Chart E information available is as follows:

a. Compartment Loading Data (Troops) (figure 4-2, sheet 2).

b. Fuel Tables (figure 4-2, sheet 3).

c. Center-of-Gravity Table (figure 4-2, sheets 7 through 9).

5-11. SOLUTION. (See DD Form 365F, figure 5-1.)

5-12. TAKEOFF WEIGHT AND MOMENT.

	Weight	Arm	Moment/100
Basic Airplane	7784	–	10,907.8
Oil	79	64.0	50.0
Pilot	200	92.6	185.0
Copilot	200	92.6	185.0
Fuel, Forward Tank	600	115.9	695.0
Fuel, Center Tank	424	183.7	779.0
Fuel, Aft Tank	554	223.1	1,236.0
2, Passenger, Compt C-13	400	95.2	381.0
2, Passenger, Compt C-14	400	112.7	451.0
2, Passenger, Compt C-15	400	130.2	521.0
2, Passenger, Compt C-16	400	147.7	591.0
2, Passenger, Compt C-17	400	165.2	661.0
2, Passenger, Compt C-18	400	182.7	731.0
2, Passenger, Compt C-19	400	200.2	801.0
	12,641		18,174.8

5-13. TAKEOFF CG.

$$cg = \frac{18{,}174.8 \times 100}{12{,}641} = 143.8$$

5-14. Referring to the center-of-gravity table (figure 4-2, sheets 7 through 9), it is seen that the cg should be between 141.5 and 144.2 for a load of 12,650 pounds (nearest to 12,641 pounds). If the cg had fallen out of the allowable limits or, in this case, if it is desired to shift the cg forward, it may be possible to remove the fuel from the aft tank. The fuel in the forward and center tank will be sufficient fuel for the flight. Computations for the removal of the fuel from the aft tank are as follows:

Take Off Condition	Weight	Moment/100
	12,641	18,174.8
Remove the Fuel From the Aft Tank	554	1236.0
	12,087	16,938.8

5-15. Corrected takeoff cg.

$$cg = \frac{16{,}938.8 \times 100}{12{,}087} = 140.1$$

5-16. Referring to the center-of-gravity table (figure 4-2, sheets 7 through 9), it is seen that the corrected takeoff cg falls within the allowable limits.

5–17. FUEL ADJUSTMENT FOR LANDING.

5–18. The fuel in the center tank and 100 lb in the forward tank will be expended during the flight. Since the arms for the fuel tanks shift as fuel is expended, it is necessary to refigure the moment/100 of the fuel expended. Enter the weight and moment/100 of the expended fuel in item 17, DD Form 365F.

Fuel Expended In Flight	Weight	Arm	Moment/100
Fuel, Forward	100	115.9	115.9
Fuel, Center	424	183.7	778.9
	524		894.8

5–19. LANDING WEIGHT AND MOMENT.

	Weight	Moment/100
Corrected Takeoff Condition	12,087	16,938.8
Fuel Expended	524	894.8
Landing Condition	11,563	16,044.0

5–20. LANDING CG.

$$cg = \frac{16{,}044.0 \times 100}{11{,}563} = 138.8$$

CAUTION

Although not included as part of the illustrative problem, control of the cg location while the helicopter is in flight (other than takeoff and landing) is also of importance. Balance limits may be exceeded in flight due to shifting loads or improper management of expendable loads. For example, passengers and unsecured (or improperly secured) loads may move and cause the cg to shift beyond the allowable limits. Care must be taken in planning for drop loads since release of these items will effect a sudden change of the helicopter weight and balance condition. Proper securing of loads, planning for drop loads, and briefing of passengers will aid in preventing unbalanced conditions in flight.

CHAPTER 13
HELICOPTER LOADING

SECTION I
SCOPE

1–1. GENERAL.

1–2. This chapter provides operating personnel with loading instructions necessary to insure maximum safety of flight conditions, safety and comfort of passengers, protection of cargo, minimum abuse to the helicopter, and delivery of load at destination in the best condition possible.

SECTION II
INTRODUCTION

2–1. GENERAL DESCRIPTION OF HELICOPTER.

2–2. Loading and tie-down data is presented in this chapter for the Models CH-34A and CH-34C helicopters, manufactured by Sikorsky Aircraft, Division of United Aircraft Corporation, Stratford, Connecticut. These helicopters are medium range, light transport helicopters used for transporting personnel and various types of military cargo.

2–3. The helicopters are designed to transport troops and general cargo of low and medium density internally or externally. A 600-pound capacity hydraulic rescue hoist with approximately 95 feet of cable is provided over the cabin door. As a personnel carrier, Model CH-34A prior to serial No. 56-4313, can transport 12 combat troops, and helicopters serial No. 56-4313 and subsequent and Model CH-34C can transport 18 combat troops. All helicopters can transport eight litter patients. Some restrictions based on the strength of the helicopter structure are necessary to control the amount and placement of cargo. These restrictions must be complied with to insure safety of the helicopter and of the crew.

2–4. PURPOSE AND USE OF THIS CHAPTER.

2–5. The purpose of this chapter is to provide information on the methods of loading, lashing, and transporting of cargo and personnel by the helicopter. Along with this information will be an explanation of the restrictions governing the loading of cargo into the helicopter.

SECTION III
HELICOPTER CARGO FEATURES

3-1. CARGO COMPARTMENT. (See figure 3-1.)

3-2. The fuselage of this helicopter contains a rectangular cargo compartment. The only obstructions in the cargo compartment are the removable auxiliary power unit (when installed) on the floor in aft left corner of the compartment and the heater duct along the ceiling. Entrance to the cargo compartment is through a sliding door (figure 3-2) on

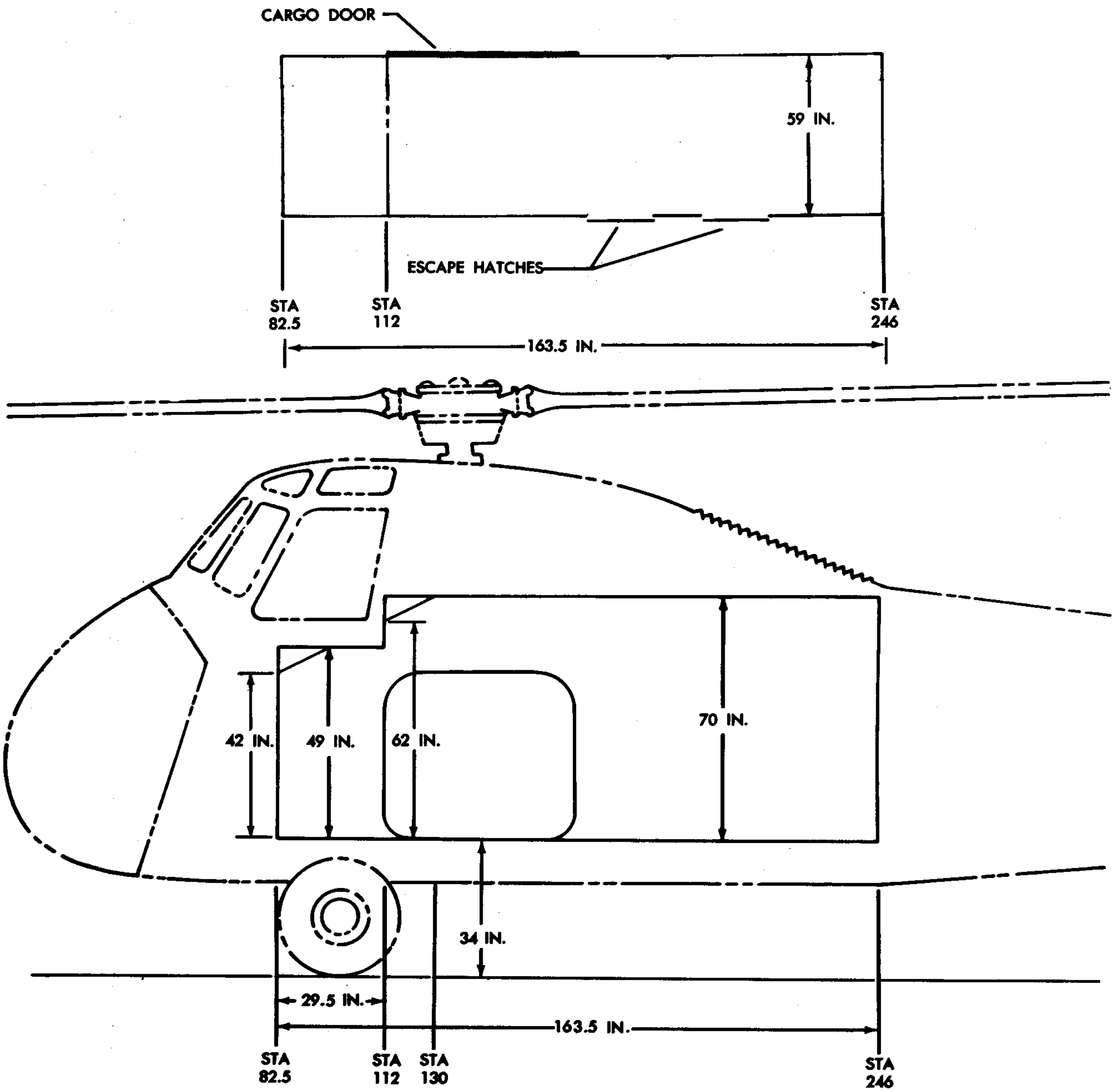


Figure 3-1. Cargo Compartment Dimensions (Sheet 1 of 2)

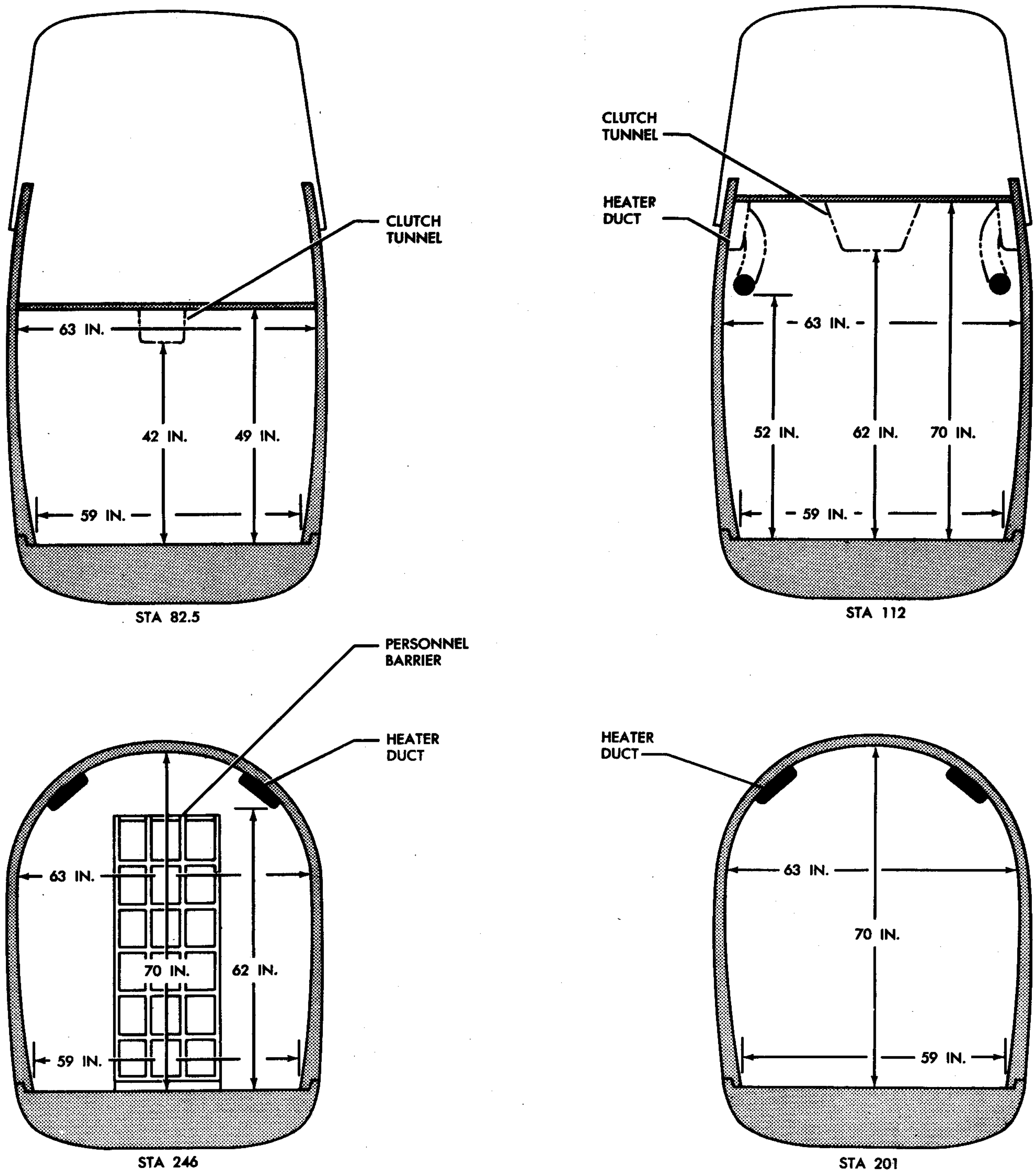


Figure 3–1. Cargo Compartment Dimensions (Sheet 2 of 2)

the right side of the fuselage. There are 35 tie-down rings (figure 3–3) in the cargo compartment floor rated at 1250 pounds each. Eighteen 1250-pound fabric cargo tie-down devices are stowed in pockets (figure 3–4) along the cargo compartment side walls.

3–3. CARGO COMPARTMENT DIMENSIONS. (See figure 3–1.) The cargo compartment is a rectangular space 163.5 inches long and 59 inches wide at floor level. Forward of station 112 the height to the cargo compartment ceiling is 49 inches, and aft of station 112 the ceiling height is 70 inches.

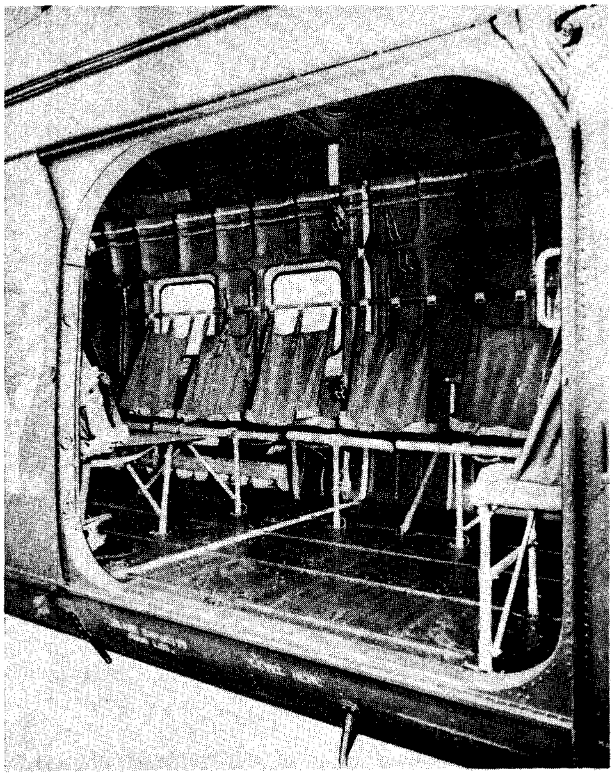


Figure 3–2. Cargo Door

However, the height to which cargo can be stacked in the helicopter is limited by the heater ducts in the ceiling and the width of the cargo. Careful consideration of these limitations will avoid unnecessary delays which result when the cargo has to be shifted.

3–4. CARGO COMPARTMENT LOADING DATA LINE. (See figure 3–5.) A line located on the floor and left-hand cargo compartment wall has the marked instructions DISTRIBUTE CARGO EVENLY ABOUT THIS LINE. Cargo should be loaded evenly fore and aft of this line. (Refer to paragraph 5–11.)

3–5. CARGO FLOOR. (See figure 3–3.)

3–6. The cargo floor is constructed of aluminum sheets with honeycomb cores of aluminum foil between the sheets. Magnesium skid strips are installed to facilitate movement of cargo and to protect the floor. The cargo floor is designed to support an evenly distributed load of 200 pounds per square foot; however, this does not mean that every square foot can be loaded to 200 pounds. (See figure 3–6.) This would exceed the weight limitations of the helicopter. Some loads exceeding the 200 pounds per square foot limitation could be loaded on the cargo floor with the use of shoring. The use of shoring is explained in paragraph 5–12.

3–7. TIE-DOWN FITTINGS. (See figure 3–7.)

3–8. A total of 35 combination tie-down and troop seat fittings (figure 3–3) are installed in the cargo floor. The ring in each fitting is capable of restraining a 1250-pound load in any direction. Figure 3–3 shows the pattern in which the fittings are installed. For desirable cone of action of tie-down fittings see figure 3–8.

3–9. CARGO COMPARTMENT ENTRANCE.

3–10. CARGO DOOR. (See figure 3–2.) The cargo door is installed on the right-hand side of the helicopter. The door is the sliding type and can be readily jettisoned from the inside or outside by turning the emergency handle and pushing or pulling the door. The door may be locked in the open position in flight for rescue operations.

3–11. ELECTRONICS COMPARTMENT PERSONNEL BARRIER.

3–12. A fabric-webbed electronics compartment personnel barrier closes off the opening in the aft cargo compartment bulkhead to prevent occupants from entering the electronics compartment during flight without first obtaining permission from the pilot. The barrier is installed to prevent the possibility of exceeding the aft center-of-gravity limit. The barrier is locked at the top and slides downward on tracks on either side of the doorway when released. The barrier lock can only be released by a switch in the pilots' compartment. The barrier is closed by pulling it up from the floor and inserting the tongue on its upper stiffener into the lock at the top of the doorway.

3–13. TROOP PROVISIONS.

3–14. 12-MAN TROOP SEATS. Nylon wall-type troop seats (figure 3–9) are installed in the cargo compartment to accommodate 12 passengers. A three-man seat and a two-man seat are installed against the right-hand cargo compartment wall, and two three-man seats and a one-man seat are installed against the left-hand cargo compartment wall. Safety belts for each of the seats are attached to eyebolt rings bolted to the rear tube of each seat. Straps are provided for securing the seats in a folded position against the cargo compartment wall. The three-man seats may be partially dismantled and rolled for more permanent stowage, or rolled and removed from the helicopter. The one-man seat and the two-man seat can only be folded against the cargo compartment wall or removed from the helicopter. These seats cannot be rolled. The aft

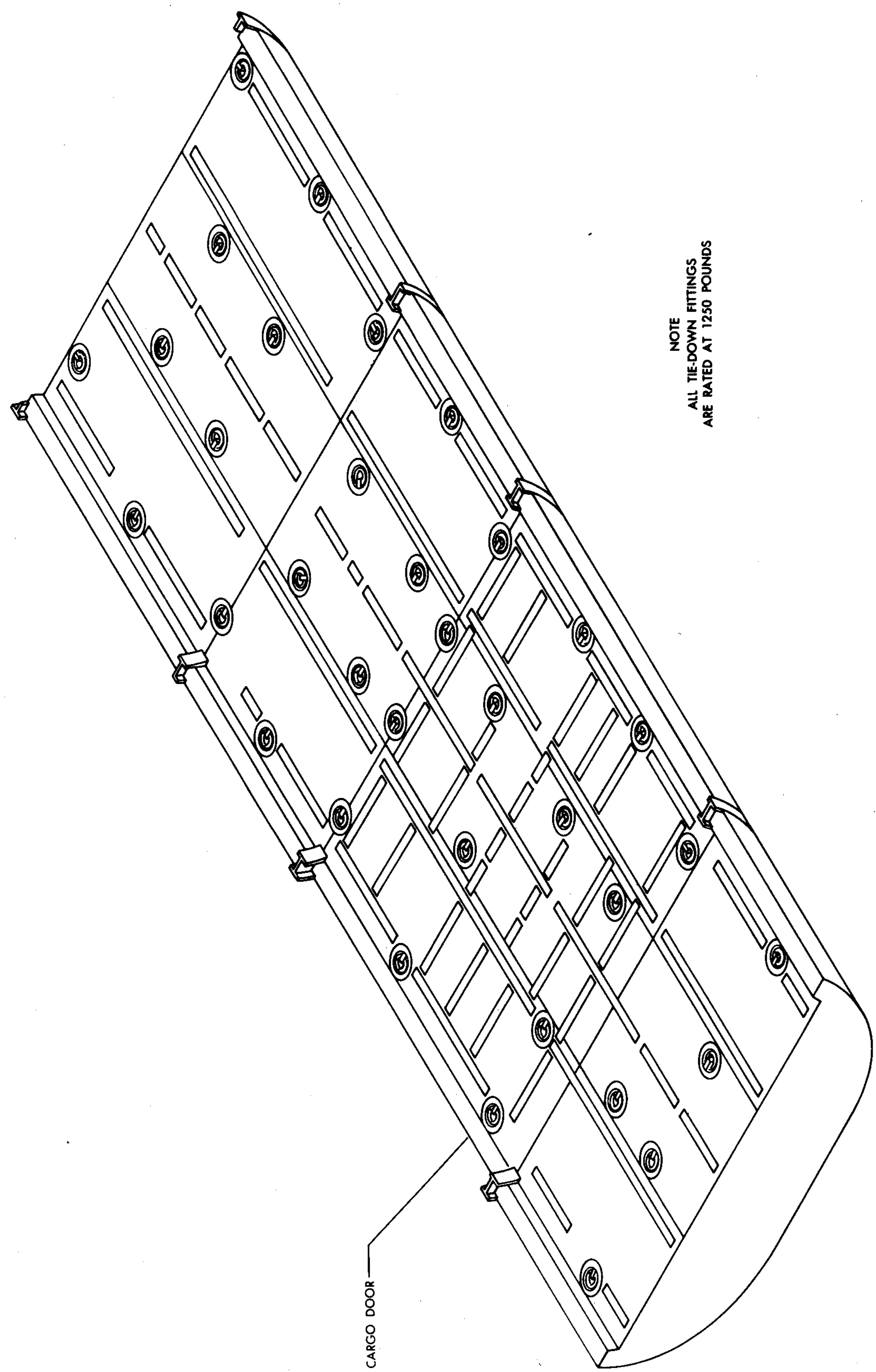


Figure 3–3. Cargo Floor

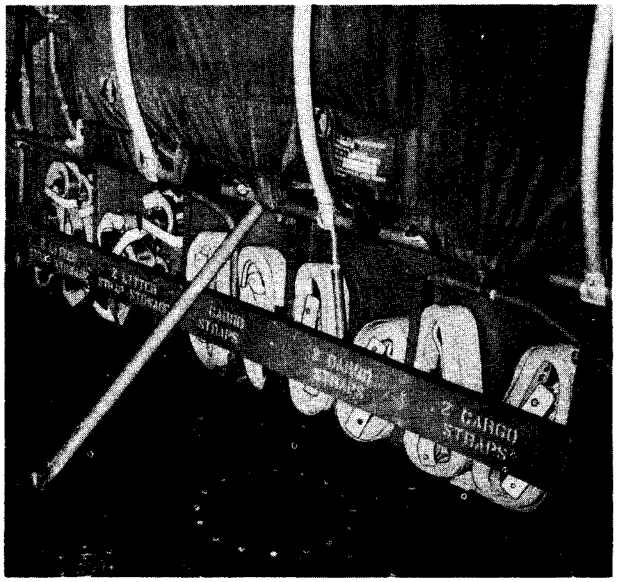
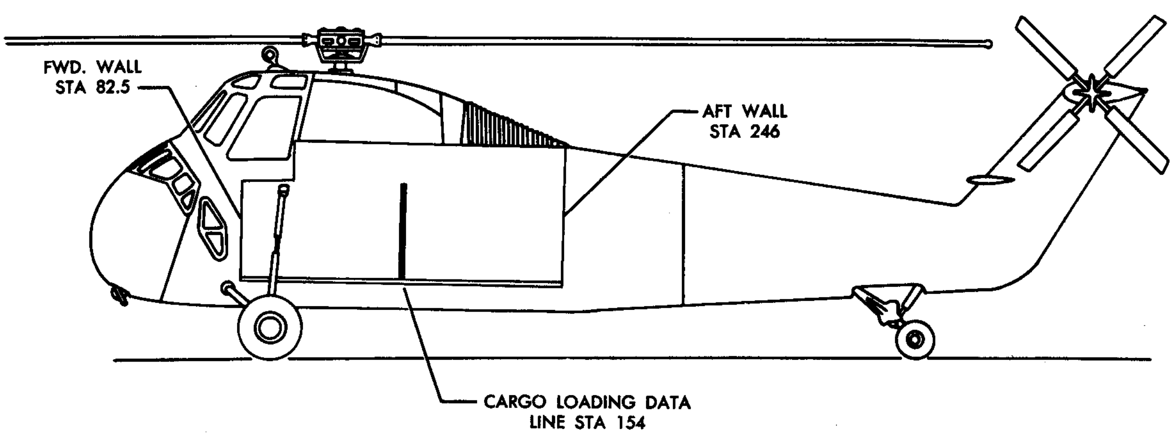


Figure 3–4. Litter Support and Cargo Devices in Stowage

section of the divided two-man seat extends into the cargo door opening and may be folded forward over the forward section of the seat to provide clearance for use of the cargo door. The back support tubes of the aft three-man seats on the left and right walls cover the emergency escape hatches and escape windows. These seat back support tubes may be quickly removed by pulling the tube inboard from the cargo compartment wall which releases the tube from spring-loaded friction fittings and permits the seat back support tube to drop down and away from the escape hatch and window area.

3–15. 18-MAN TROOP SEATS. (See figure 3–10.) Aluminum, wall-type, 18-man troop seats, with cushioned seat and nylon backrests, are installed in the cargo compartment. A nine-place troop seat installation is installed against the left-hand cargo compartment wall. A four and one-half place troop seat, a one and one-half place troop seat, and a three-place combination seat-step are installed against the right-hand cargo compartment wall. Hooks installed at the top of each seat backrest secure the seat backrest to a support tube mounted above the seats on the cargo compartment wall. Safety belts for each troop seat are attached to eyebolt rings on the lower rear tube of the seats. Securing straps with hooks are provided for securing the seats in the folded position against the cargo compartment wall with the exception of the seat-step combination which is readily removed. The troop seats may be removed when the additional space is needed. Quick access to the emergency escape hatches in the left-hand cargo compartment wall is gained by pulling the seat backrest support tubes away from the cargo compartment wall and out of the spring-loaded friction fittings. This will permit the seat backrest and support tube to drop down and away from the escape hatches and escape windows.



NOTES

1. TOTAL CARGO WEIGHT INCLUDING CARGO SLING LOADING MUST NOT EXCEED 5000 POUNDS. TOTAL WEIGHT OF HELICOPTER 13,300 POUNDS.
2. CARGO WEIGHT MUST BE DISTRIBUTED EVENLY ON BOTH SIDES OF THE CARGO COMPARTMENT LOADING DATA LINE.

Figure 3–5. General Cargo Compartment and Load Diagram Data

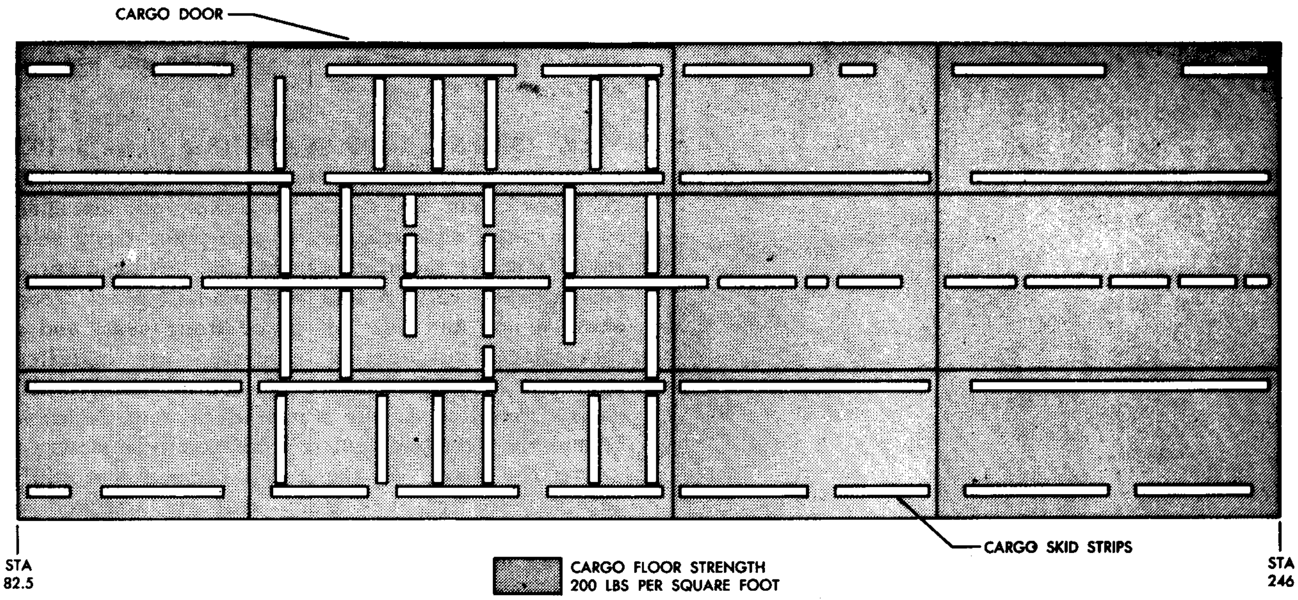


Figure 3–6. Cargo Floor Strength Areas

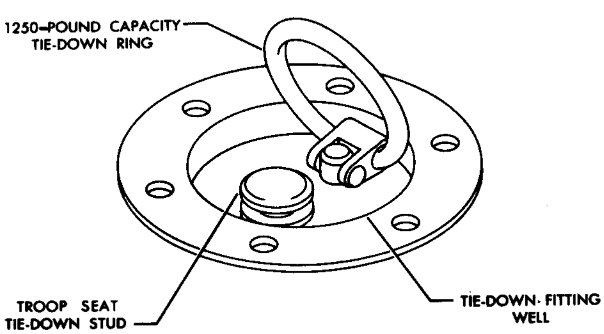


Figure 3–7. Tie-Down Fitting

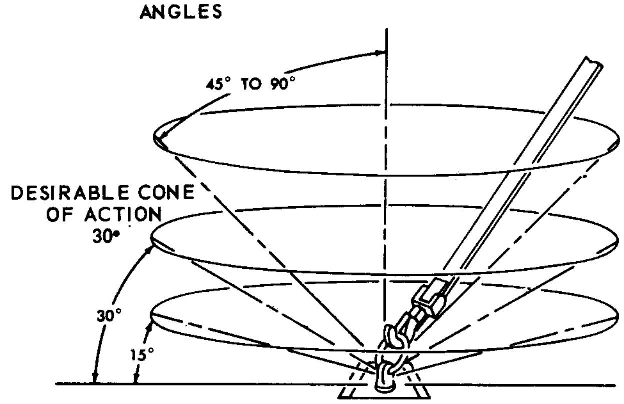


Figure 3–8. Tie-Down Fitting Desirable Cone of Action

3–16. COMBINATION SEAT-STEP. A combination seat-step, part of the 18-man troop seat installation, is mounted at the cargo door. In the closed (seat) position (figure 3–11) the seat-step accommodates three troops and appears similar to the adjacent troop seats. In the open (step) position the seat-step is pivoted outboard through the cargo door. The underside of the seat-step serves as a step which permits easy passage in or out of the helicopter. Fittings mounted on the cargo door frames serve to lock the seat-step in the closed (seat) position. Fittings integrated with the cargo sling support fittings serve to lock the seat-step in the open (step) position. Pulling the handle of a release cable, secured to the cargo floor just inside the cargo door, frees the seat-step from either set of lock fittings. A bungee cord on the step side of the seat-step serves as an aid in handling. An instruction plate, mounted over the cargo door, gives necessary information for the proper operation of the seat-step.

3–17. LITTERS. (See figure 3–12.) Eight litters may be installed in the cargo compartment. The litters are arranged in two tiers of four litters, one tier located on each side of the cargo compartment. The litters are supported outboard in brackets secured to the cargo compartment walls and inboard in brackets on the litters' support strap assembly suspended from fittings in the cargo compartment ceiling. The bottom of the litter support strap is

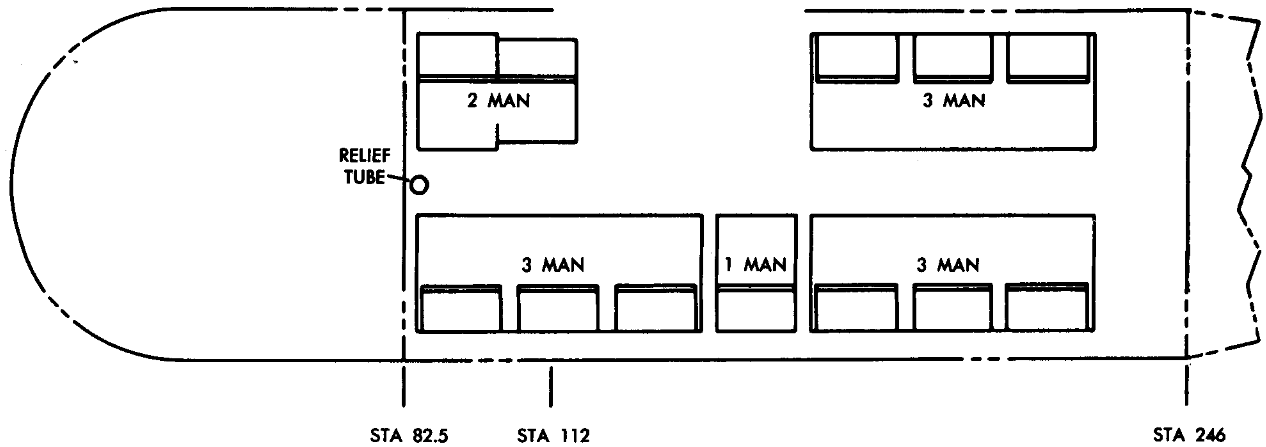


Figure 3–9. 12-Man Troop Seat Seating Arrangement

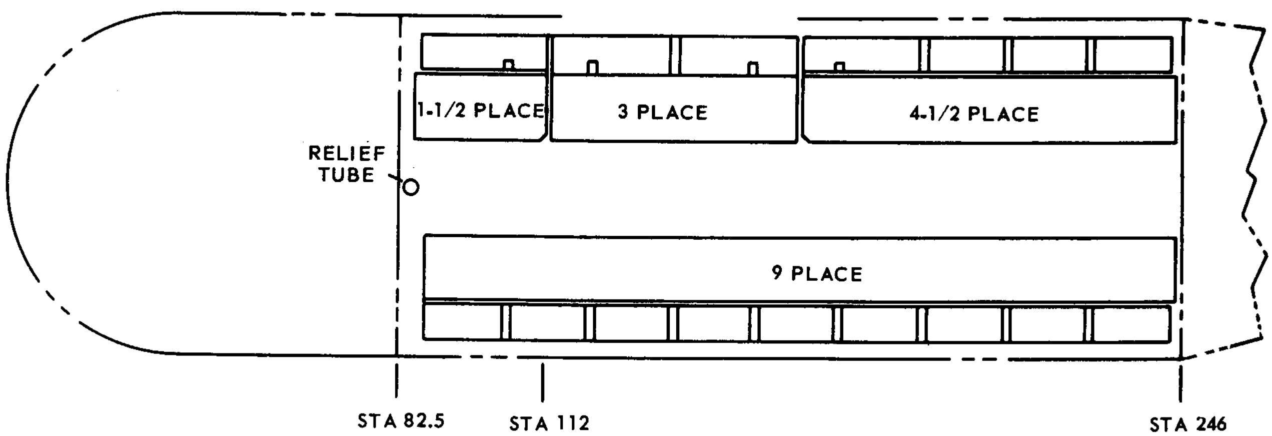


Figure 3–10. 18-Man Troop Seat Seating Arrangement

secured to the cargo tie-down fitting with a hook located at the base of the bottom bracket. When not in use, the litter support strap assemblies are stowed on both sides of the cargo compartment at floor level. (See figure 3–4.) The wall litter support brackets for the second and third litter are stowed in a utility bag (figure 3–13) secured to the aft left-hand side of the cargo compartment wall.

3–18. LITTER AND TROOP SEAT COMBINATIONS. Both litters and troop seats may be installed in the helicopter at the same time if the mission calls for such a combination. On helicopters equipped with the 12-man troop seat configuration, four litters and nine troop seats may be installed if the litter tier on the right-hand cargo compartment wall is used. If the litter tier on the left-hand cargo compartment wall is used, only five troop seats can be used. On helicopters equipped with the 18-man troop seat configuration, four litters and 10 troop seats may be installed if the litter tier on the right-hand cargo compartment wall is used. If the litter tier on the left cargo compartment wall is used, nine troop seats, including the seat-step, may be used. If both litter tiers are installed, only the forward right-hand side troop seats can be used.

Note

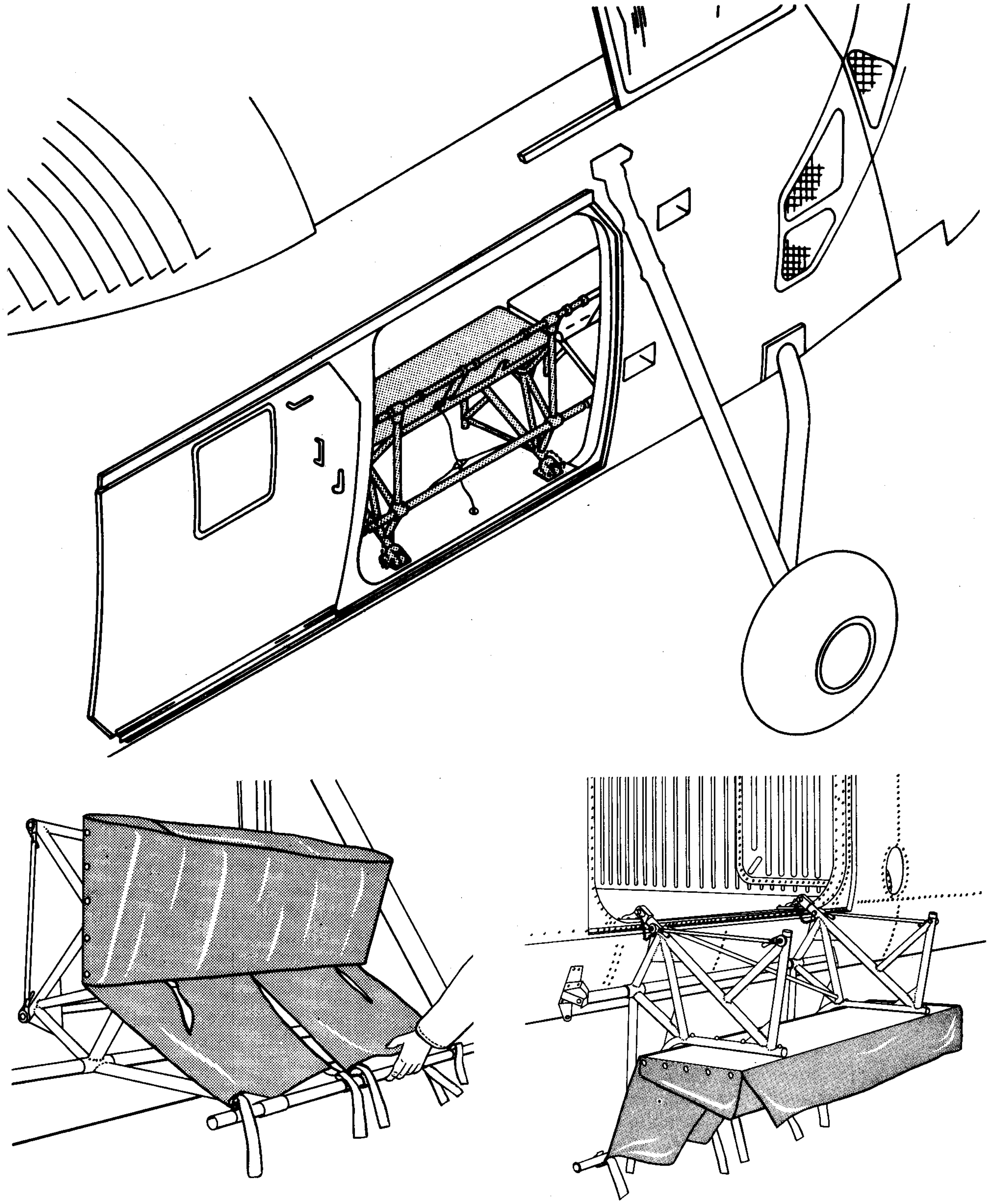
Troop seat back support tube fittings must be removed to install third wall litter support bracket. Both troop seats and third litters have same wall location for attaching their support fitting.

3–19. EMERGENCY EXITS.

3–20. Refer to Chapter 4, Section V.

3–21. EMERGENCY EQUIPMENT.

3–22. Refer to Chapter 4.



A B

Figure 3–11. 18-Man Troop Seat Combination Seat-Step Installation

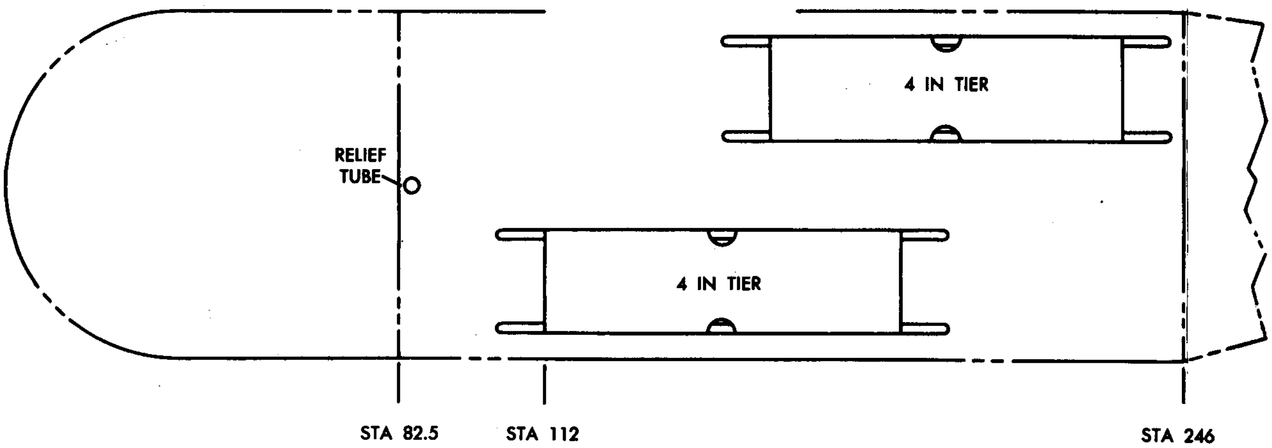


Figure 3–12. Litters

3–23. EMERGENCY EQUIPMENT CHECKLIST.

a. First aid kits in position and complete.

b. Fire extinguisher installed and with the proper amount of pressure.

c. Flashlights in position and operating.

d. Crew alarm bell operating.

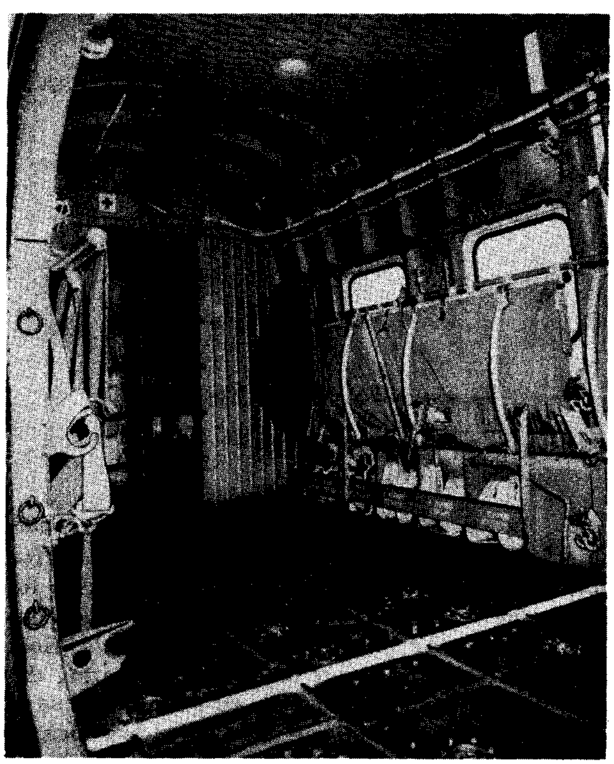


Figure 3–13. Rear View Cargo Compartment

3–24. RESCUE HOIST.

3–25. Refer to Chapter 6, Section IV

3–26. EXTERNAL CARGO SLING. (See figure 3–14.)

3–27. Helicopter operations with external loads will normally be employed to expedite loading and off-loading of prepackaged loads. It will also afford a means of delivery during operations in rugged areas where the motor vehicles cannot function and transport aircraft cannot land, but where helicopters are capable of hovering. The following information is limited and is intended only to be a guide for external loading and unloading. When qualified data is received, it shall be incorporated in the following revision. The cargo sling is stowed beneath the fuselage when not in use. (See figure 3–15.)

CAUTION

On helicopters with magnesium tubs, serial No. 53-4475 through 55-4504, cargo sling has a capacity of 4000 pounds. On helicopters with aluminum tubs, serial No. 56-4284 and subsequent, fuselage is reinforced to provide cargo sling with a capacity of 5000 pounds.

3–28. CARGO SLING HOOK. (See figure 3–16.) The cargo sling hook may be opened and closed by personnel on the ground. The cargo sling hook is opened by moving the lever forward to the OPEN position indicated on the hook. The hook is closed by pushing the latch up.

3–29. CARGO SLING STOWAGE LINE. The cargo sling stowage line (figure 3–17), attached to the

Figure 3–14. Cargo Sling

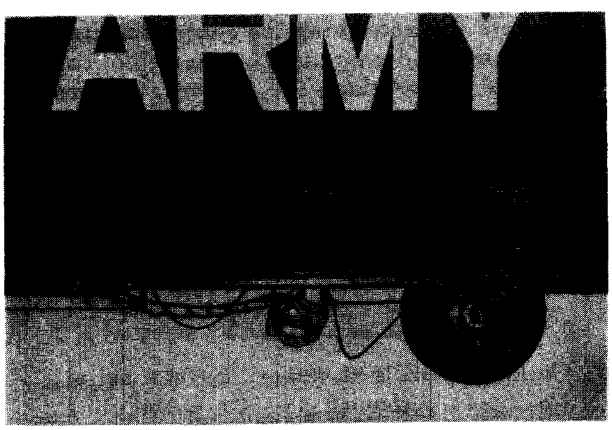


Figure 3–15. Cargo Sling in Stowed Position

cargo sling hook, passes into the cabin on the left side and is secured to a cleat located on the cabin left-hand wall. To stow the cargo sling, pull in on the line and secure it to the cleat. To unlatch the cargo sling from its stowed position, grasp the line (to prevent the sling hook from falling to the ground), cast it off from the cleat, and pay out.

3–30. CARGO FLOODLIGHT.

3–31. Refer to paragraph 3–10, Chapter 6.

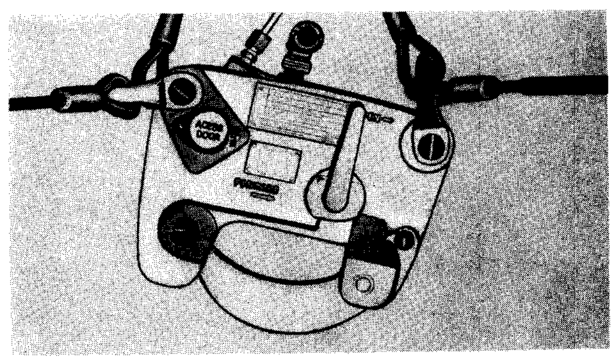


Figure 3–16. Cargo Sling Hook

3–32. AIR SAFETY HARNESS.
(See figure 3–18.)

3–33. An air safety harness, consisting of webbed shoulder straps, waist belt, and a connecting line with a snap hook is installed in the helicopter for use during rescue missions. The hook on the connecting line may be attached to any of the floor tie-down rings to prevent the person operating the hoist from falling out. When the air safety harness is not in use, it is stowed in the utility bag located on the aft section of the left-hand wall of the cargo compartment.

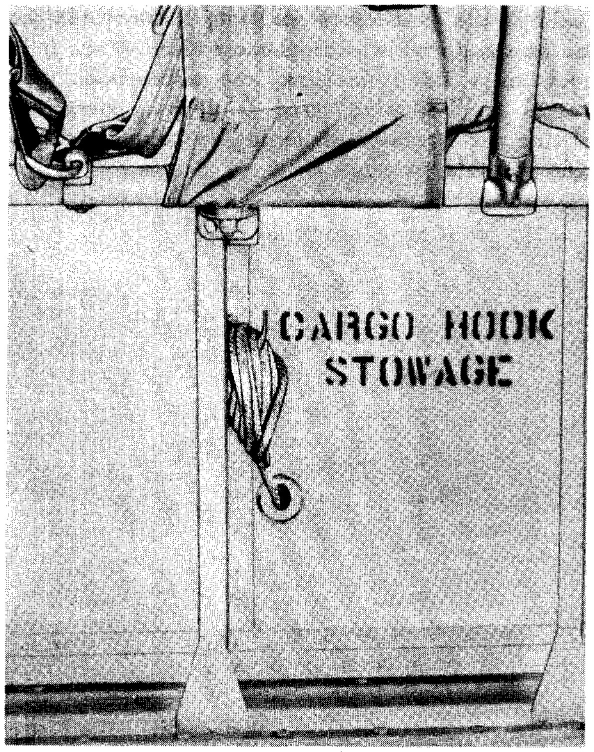


Figure 3–17. Cargo Sling Hook Stowage Line Tie-Down Cleat

3–34. UTILITY STOWAGE BAG.

3–35. A utility stowage bag is located on the aft left-hand side of the cargo compartment wall (figure 3–13). Litter wall support brackets, troop seat fittings, and black-out curtains are stowed in the bag when not in use.

3–36. COMFORT PROVISIONS.

3–37. One relief tube is located on the forward wall in the cargo compartment so that it is accessible to the pilots and passengers.

3–38. CARGO COMPARTMENT COMMUNICATION STATION.

3–39. The cargo compartment communication station is located on the right-hand side of the upper forward bulkhead of the cargo compartment. The station is provided with a headset and a microphone, a hook for supporting the headset, and a bracket-mounted, portable microphone switch. The station includes a signal distribution panel identical to the pilot's and copilot's except that the transmitting switch is operable only for transmitting over interphone and not over radio; the switch

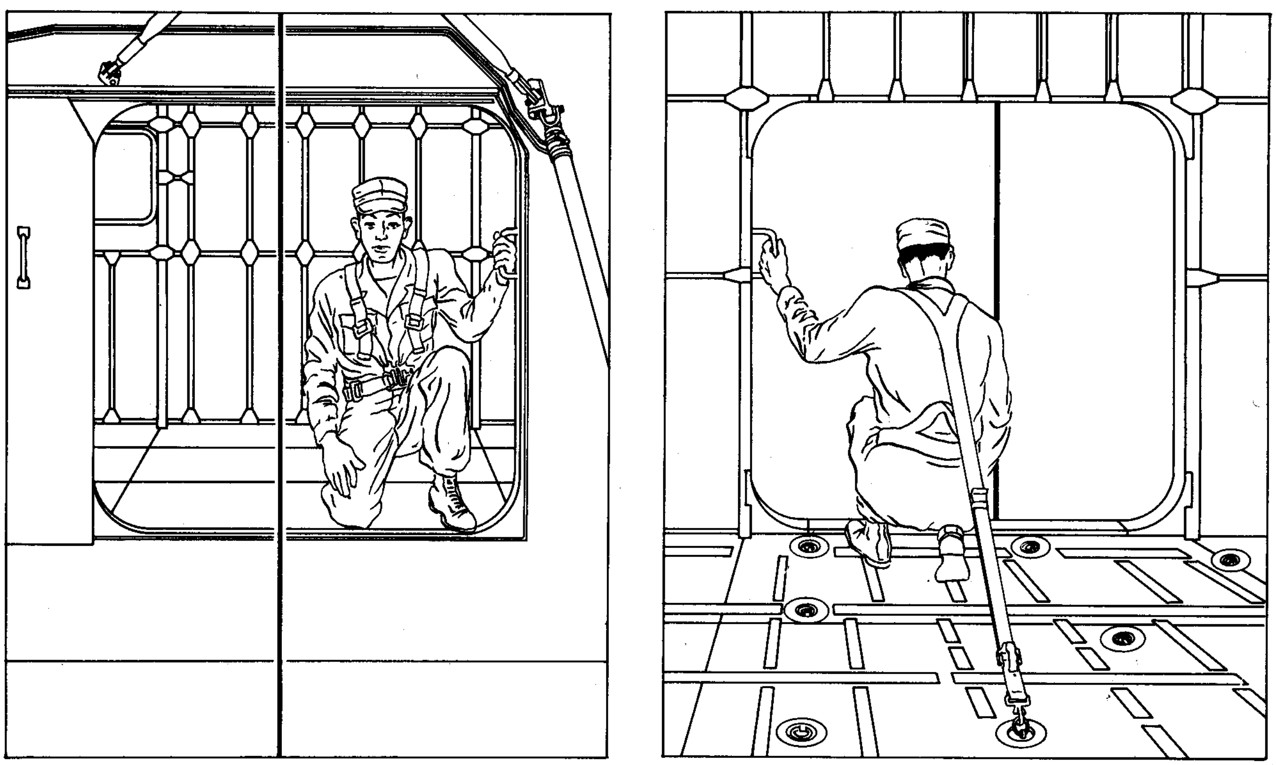


Figure 3–18. Air Safety Harness

should be left in the INT position. The communication station is also equipped with a hot mike switch mounted alongside of the distribution panel. The switch has both a momentary and a fixed position and is connected in parallel with the portable microphone push-to-talk switch. When the switch is held in the momentary position, it functions the same as the portable microphone switch. When it is placed to a fixed position, the microphone then becomes a "hot mike" and is always operative, relieving the operator of having to hold his thumb on the portable switch.

SECTION IV

PREPARATION OF HELICOPTER AND PERSONNEL CARGO FOR LOADING AND UNLOADING

4-1. PERSONNEL LOADING AND UNLOADING.

4-2. CHECKLIST. In addition to the usual preflight preparations, the following procedures should be accomplished when preparing the helicopter for the transportation of personnel:

a. Remove all unnecessary articles from cargo compartment,

b. Fold, stow, remove, or install troop seats and/or litters as described in this section.

c. Check that safety belts are provided for each seat.

d. Check that emergency exists are clear.

e. Check that emergency equipment is installed and in proper working order.

f. Check that parachutes are available when required.

g. Inspect jettison mechanisms on escape hatches and doors.

CAUTION

Do not release jettison mechanisms on escape hatches and doors.

h. Check for presence and condition of comfort provisions.

i. Check landing gear for proper extension stated on strut.

4-3. TROOP SEATS.

4-4. There are two types of troop seat installations; a 12-man troop seat installation and an 18-man troop seat installation.

4-5. 12-MAN TROOP SEATS. (See figure 4-1.)

4-6. When 12-man troop seats are not used:

a. All seats may be folded against cargo compartment wall.

b. Three-man seats may be rolled and stowed with one-man and two-man seats folded.

c. All seats may be removed from helicopter.

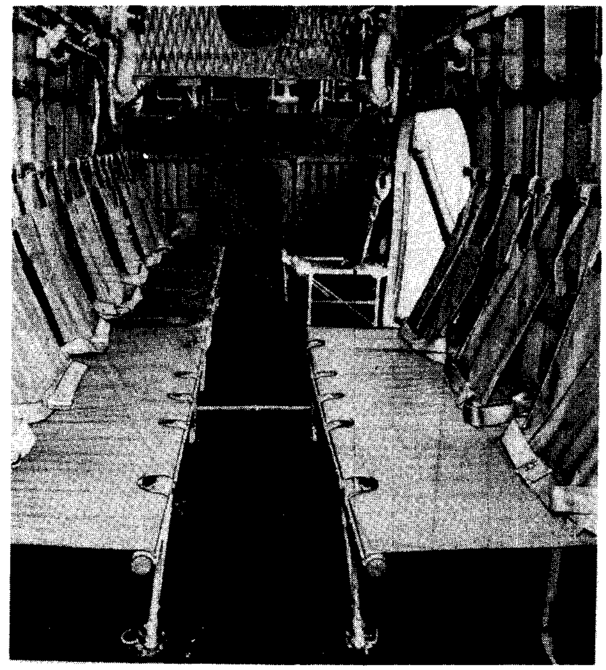


Figure 4-1. 12-Man Troop Seats

d. All seats may be left in sitting position for rapid loading of troops.

4-7. 12-MAN TROOP SEAT INSTALLATION. (See figure 4-2.)

4-8. INSTALLATION OF THREE-MAN TROOP SEATS ON LEFT-HAND SIDE OF CARGO COMPARTMENT.

a. Install troop seat backs support tube into friction fitting (detail A, figure 4-2) and bolt fitting. Install bolt, washers, and nut through bolt fitting and tube. (See detail B.)

Note

Sections of troop seat backs support tubes, which pass in front of emergency exits, are held in place by friction fittings which allow a quick removal.

b. After troop seat rear support tube is installed, unfold troop seat as in paragraph 4-12, step *f.*

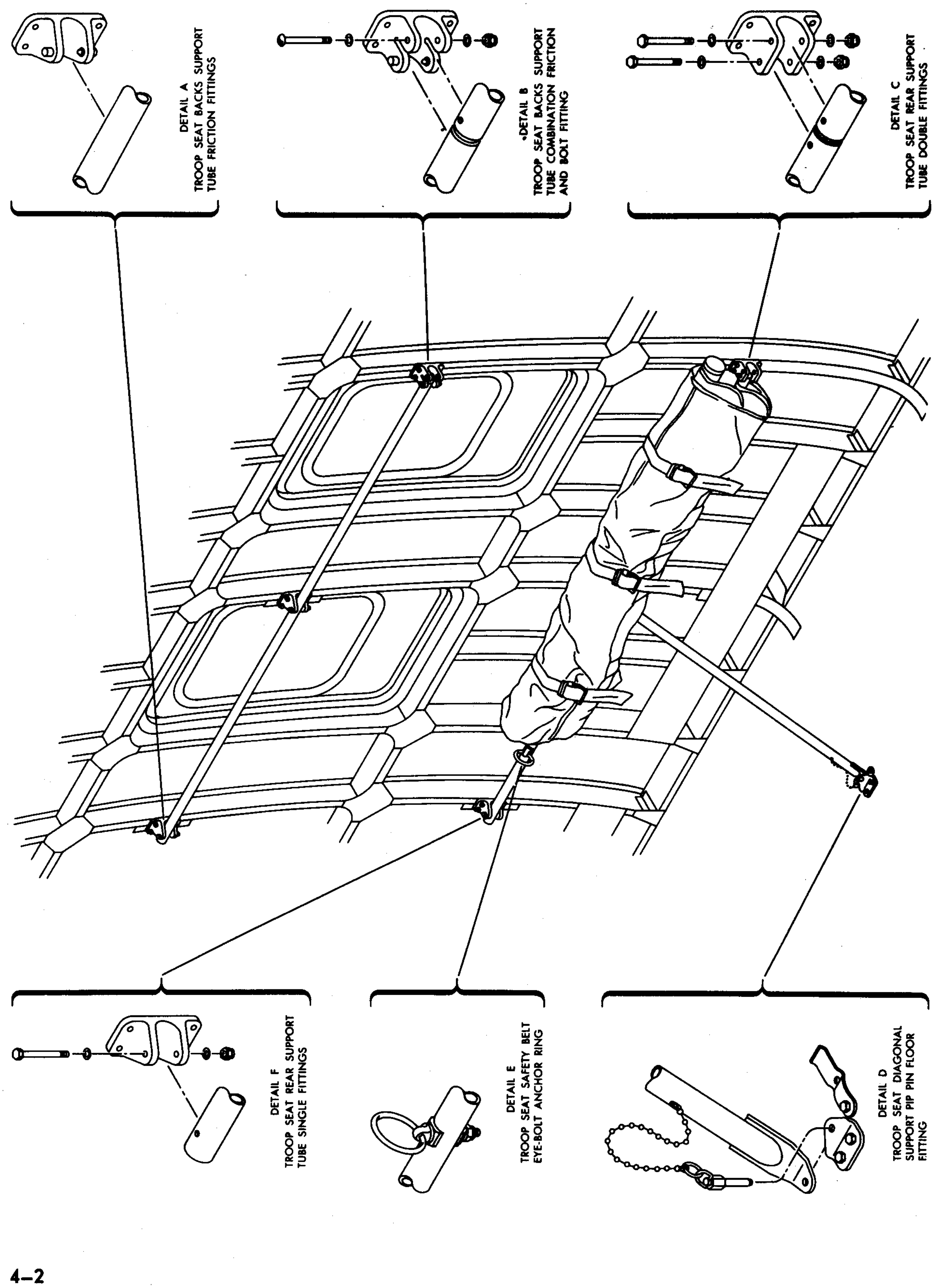


Figure 4–2. 12-Man Troop Seat Installation

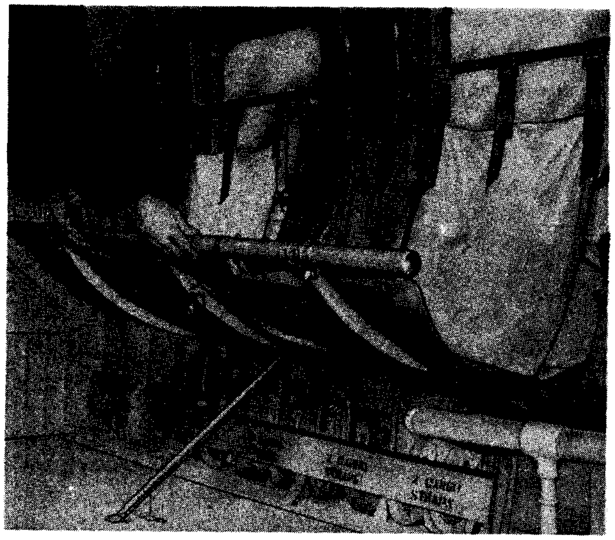


Figure 4–3. Folding 12-Man Troop Seats Against Cargo Compartment Wall

4–9. INSTALLATION OF TWO-MAN TROOP SEAT ON FORWARD RIGHT-HAND SIDE OF CARGO COMPARTMENT WALL.

Note

If helicopter was used to carry litters, it will be necessary to install four troop seat back support tube fittings, detail A, figure 4–2.

a. Insert seat backs support tube into friction fittings. (See details A and B, figure 4–2.)

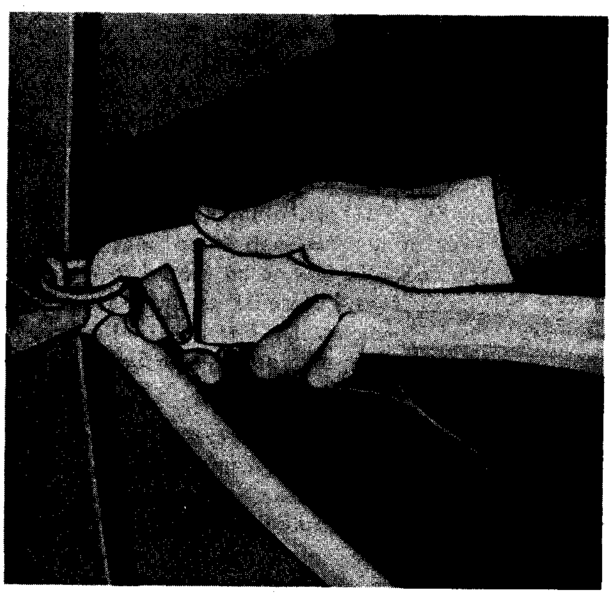


Figure 4–4. Attaching Troop Seat Safety Belt

b. Install two-man troop seat by installing bolts, washers, and nuts (details C and F, figure 4–2) and secure seat support tube to cargo compartment.

c. Unfold two-man troop seats as shown in figure 4–3 in reverse order.

d. Connect troop seat safety belt to eye bolts on seat support rear tube. (See figure 4–4.)

e. Extend diagonal support tube and position in floor fitting. Secure in place with pip pin. (See detail D, figure 4–2.)

f. Unroll and/or unfold three-man troop seats, and unfold one-man troop seat as required. (Refer to paragraphs 4–11 and 4–12, step *f.*)

4–10. INSTALLATION OF THREE-MAN TROOP SEAT ON RIGHT-HAND SIDE OF CARGO COMPARTMENT. Install three-man troop seat on right-hand side of cargo compartment following same steps listed in paragraph 4–9.

4–11. UNROLLING THREE-MAN SEATS. (See figure 4–5.)

a. Open stowage straps and unroll troop seats as shown in figure 4–6.

b. Extend seat spreader in a direction opposite to that shown in figure 4–7 and tighten bolt on clamp end of spreader.

c. Release tension by adjusting thumb screw on leg (figure 4–8) and extend leg and brace in upright position.

d. Connect seat leg and brace by inserting pip pin through brace fitting and leg fitting.

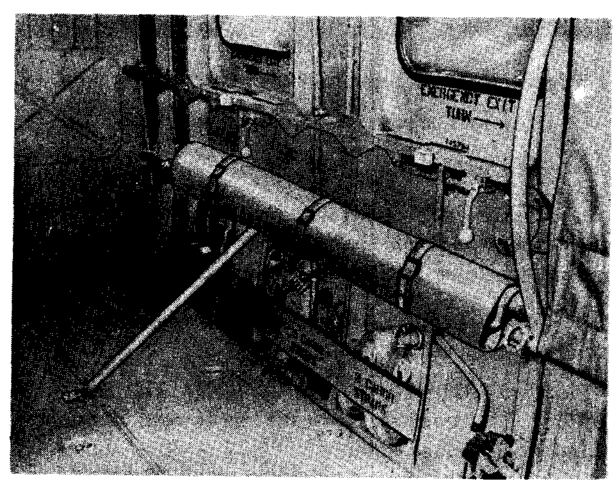


Figure 4–5. 12-Man Troop Seat Rolled and Stowed

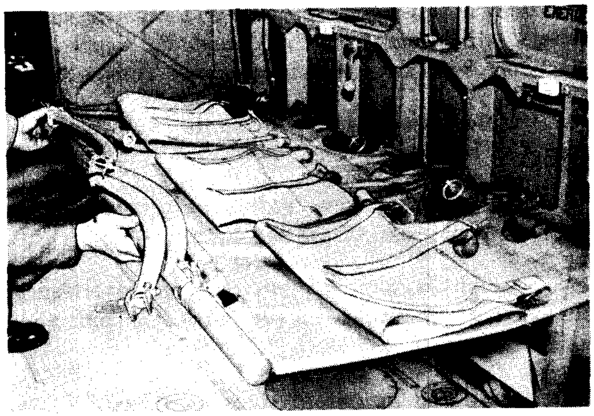


Figure 4–6. 12-Man Troop Seat Legs and Spreaders Folded Ready to Roll

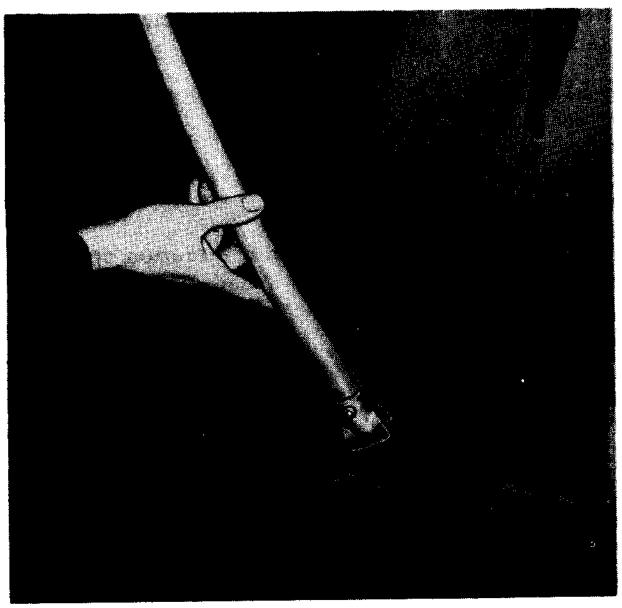


Figure 4–7. Disconnecting and Folding End of Spreaders on 12-Man Troop Seat

e. Rotate legs down until leg is centered over cargo floor tie-down fitting stud; press on leg until leg and tie-down fitting are engaged.

f. Connect troop seat back hooks to troop seat backs support tube.

4–12. FOLDING ONE-MAN AND THREE-MAN SEATS. The one-man and the three-man seats are folded in the same manner.

a. Press in ears on lower ends of legs (figure 4–9) and pull up, releasing legs from tie-down fitting stud.

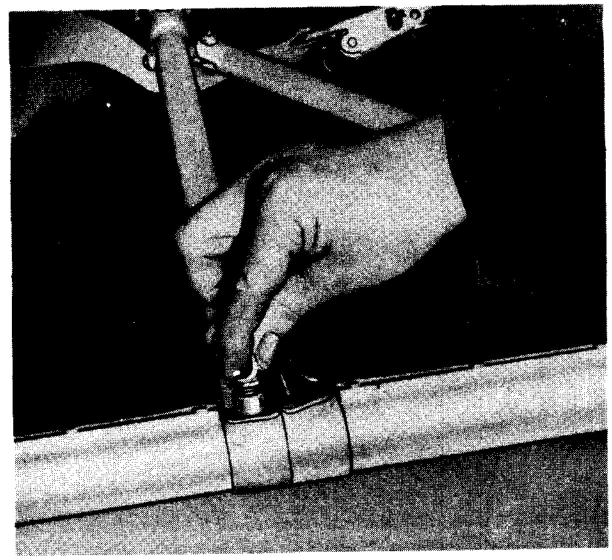


Figure 4–8. Adjusting Thumb Screw on Leg of 12-Man Troop Seat for Tension Adjustment

b. Release thumb screw (figure 4–8) on back of each leg to allow leg to rotate independently of seat front tube.

c. Raise legs and turn them over onto seats (figure 4–10) and apply tension on thumb screw (figure 4–8).

d. Fold seats against seat backs (figure 4–3) and secure with stowage straps (figure 4–11) attached to seats and to seat back support tubes (figure 4–12).

e. Remove pip pin from floor fitting and rear seat tube diagonal support (detail D, figure 4–2) and fold diagonal support against troop seat.

f. To unfold troop seat, follow preceding steps in reverse order.

4–13. FOLDING TWO-MAN TROOP SEATS. The right-hand seat of the two-man troop seat extends into the cabin door and has to be folded forward on to the left-hand seat before it is folded against the cargo compartment wall. For detailed instructions on folding the two-man seats, see figure 4–13.

4–14. ROLLING AND UNROLLING OF THREE-MAN TROOP SEATS. The three-man troop seats can be rolled and stowed against the cargo compartment wall. The one-man and two-man seats cannot be rolled; they must be folded in place for stowage.

4–15. ROLLING THREE-MAN TROOP SEAT.

a. Unhook seat backs and fold on seat properly. (See figure 4–14.)

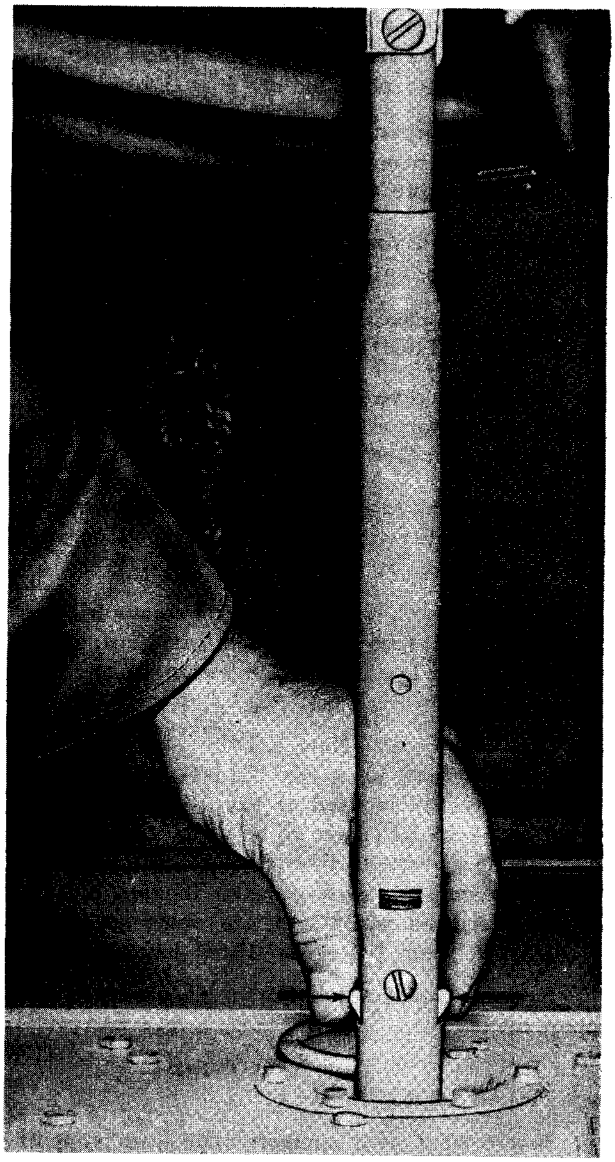


Figure 4–9. Releasing Seat Leg from Cargo Floor Tie-Down Fitting Stud

b. Release legs from floor and rotate up as in paragraph 4–12, steps *a* and *b,* then proceed as follows:

c. Disconnect leg brace by pulling out on pip pin and removing brace. (See figure 4–15.)

d. Extend leg and brace on forward edge of seat. (See figure 4–16.)

e. Disconnect and fold seat spreader. (See figure 4–7.)

f. With legs and spreaders folded, roll seat to compartment wall. (See figure 4–6.)

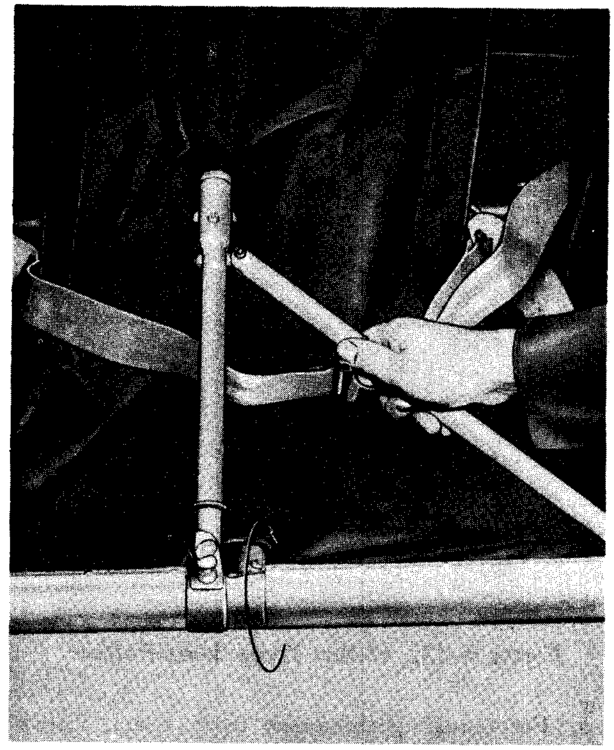


Figure 4–10. Turning Seat Leg Over on Seat of 12-Man Troop Seats

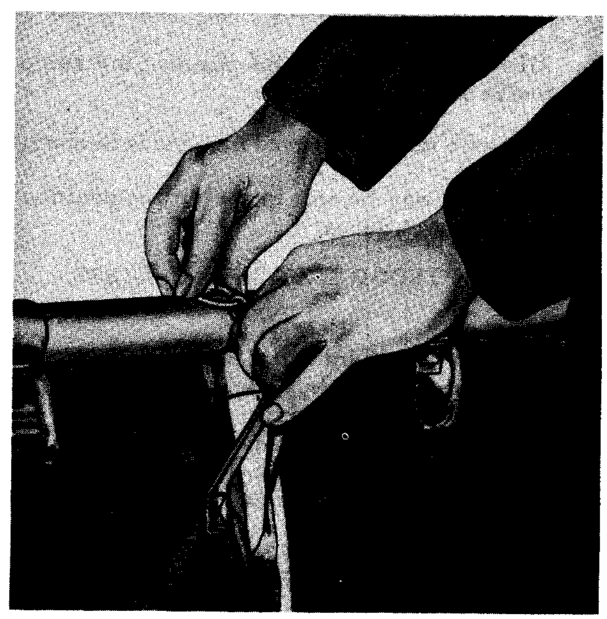


Figure 4–11. Securing Folded 12-Man Troop Seat with Stowage Strap

g. Roll three-man seats compactly and secure seat to lower seat support tube with stowage straps. (See figure 4–5.)

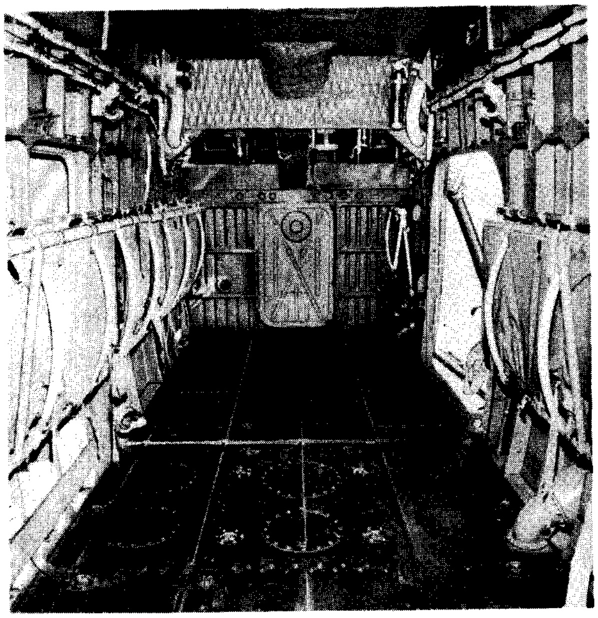


Figure 4–12. 12-Man Troop Seats Folded

b. For unrolling three-man troop seats, follow preceeding steps in reverse order.

4–16. 18-MAN TROOP SEATS. (See figure 4–17.)

4–17. When the 18-man troop seats are not used:

a. All seats may be folded against the cargo compartment wall.

b. All seats may be removed from the helicopter.

c. All seats may be left in the sitting position for rapid loading of troops.

4–18. 18-MAN TROOP SEAT INSTALLATION.

Note

If second and third litter wall brackets are installed, they must be removed and replaced with support tube fittings using same bolts, washers, and nuts. Fittings are stowed in stowage bag, located on aft portion of left cargo compartment wall.

4–19. INSTALLING NINE-MAN TROOP SEAT ON LEFT-HAND SIDE OF CARGO COMPARTMENT.

a. Line up seat rear support tube on support fitting on cargo compartment wall, and install push-button pins. (See detail C, figure 4–18).

b. Extend diagonal support bar and insert end into floor fitting. Install pip pin. (See detail D, figure 4–18.)

c. Lower seat and position seat legs over troop seat tie-down stud (figure 3–7) and press down on seat until seat legs and stud are engaged.

d. Install upper troop seat backs support tube into cargo compartment wall support friction fittings. (See detail A, figure 4–18.)

e. Connect seat back hooks to seat backs support tube.

4–20. INSTALLING FOUR AND ONE-HALF PLACE TROOP SEAT.

a. Install troop seat rear support tube in support fittings on cargo compartment wall and install push-button pins. (See detail C, figure 4–18.)

b. Install seat leg on cargo floor tie-down stud by placing leg over stud and pressing down on seat until leg and stud are engaged.

c. Install seat backs support tube into friction fitting. Forward tube is pressed into fitting; aft tube will be bolted in place as in detail B, figure 4–18.

Note

If litters have been installed last, litter wall brackets located at each end of the forward tube will have to be replaced with troop seat support tube fittings. Fittings are stowed in stowage bag located on rear left-hand walls and use same nuts, washers, and bolts as litter brackets.

d. Connect seat back hooks to troop seat backs support tubes.

4–21. INSTALLING ONE AND ONE-HALF PLACE TROOP SEAT.

a. Insert seat rear support tube into support fittings on cargo compartment wall and secure with push-button pins. (See detail C, figure 4–18.)

b. Place seat leg on the cargo floor tie-down stud and press on seat until leg and stud are engaged.

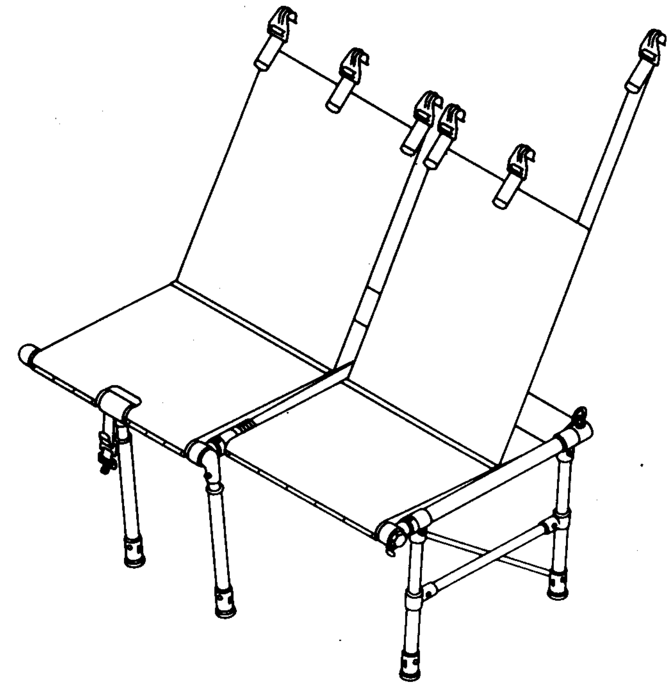
c. Connect troop seat back hook to support tube.

4–22. INSTALLING TROOP SEAT SEAT-STEP COMBINATION.

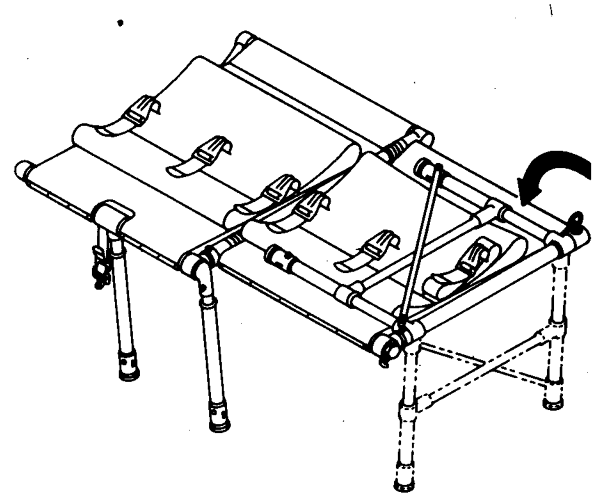
a. Hold troop seat seat-step combination in place on cargo floor hinges. (See detail A, figure 3–11.)

b. Install push-button pin in troop seat step and cargo floor hinge fitting. (See figure 4–19.)

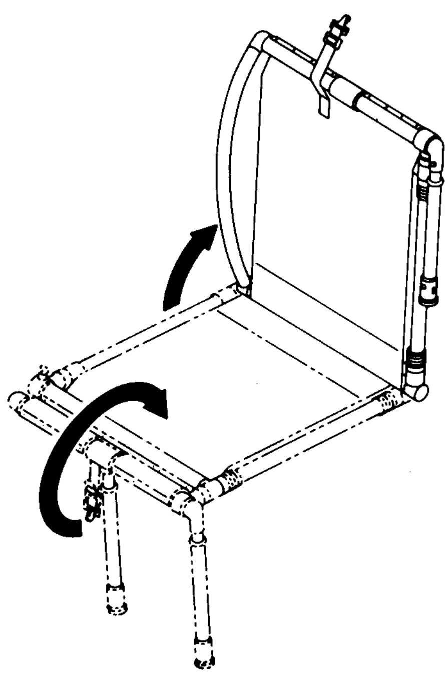
c. Allow seat-step combination to pivot down into step position until lockpins engage. (See detail B, figure 3–11.)



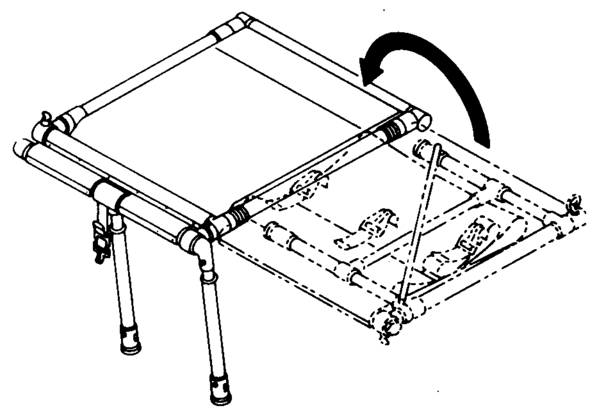
A TWO-MAN TROOP SEAT INSTALLED



B 1. UNHOOK SEAT BACKS FROM TROOP SEAT BACKS SUPPORT TUBE
2. RELEASE RIGHT-HAND SEAT LEGS FROM CARGO FLOOR TIE-DOWN FITTING STUD (SEE FIGURE 3–3)
3. TURN LEGS OVER TO REST ON SEAT



D 1. RELEASE THE LEFT-HAND SEAT LEGS FROM THE CARGO FLOOR TIE-DOWN FITTING STUD AND TURN OVER ONTO SEAT
2. FOLD THE LEFT-HAND SEAT WITH THE RIGHT-HAND SEAT ON IT AGAINST THE CARGO COMPARTMENT WALL AND SECURE WITH THE TIE-DOWN STRAP PROVIDED ON IT



C TURN THE RIGHT-HAND SEAT, WITH LEGS FOLDED, OVER AND REST ON LEFT-HAND SEAT

Figure 4–13. Folding Two-Man Troop Seats of 12-Man Troop Seats

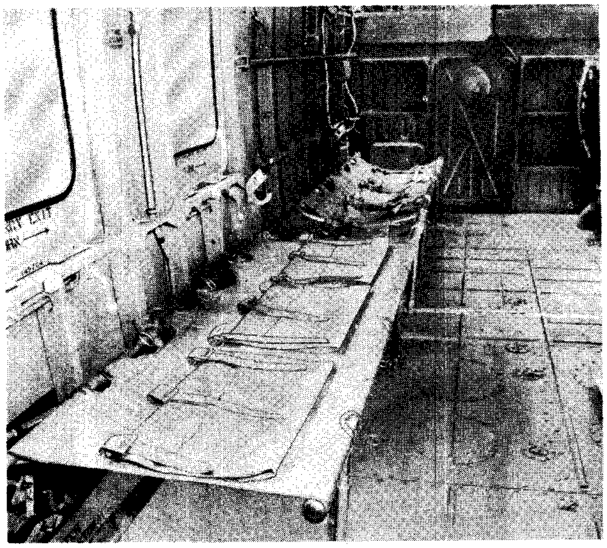


Figure 4–14. Troop Seat Backs Folded on Seats

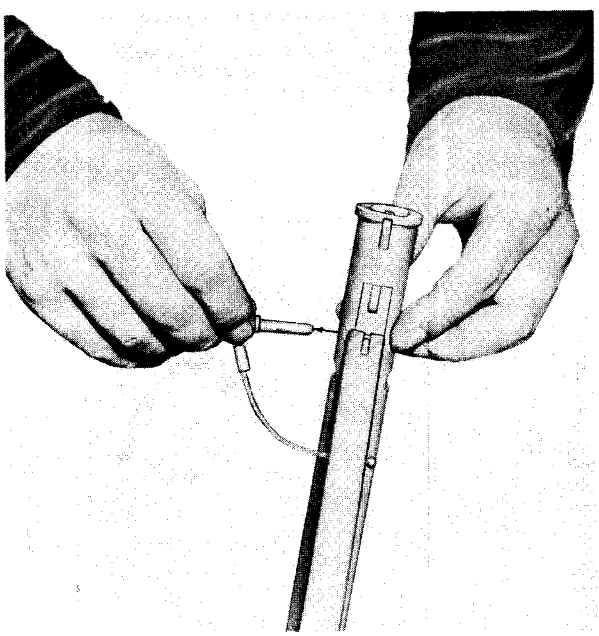


Figure 4–15. Disconnecting Seat Leg Brace on 12-Man Troop Seats

d. To remove seat-step combination, follow installation procedures in reverse order.

e. Put seat step in seat position by pulling release handle (figure 4–20) and pivot seat step into cargo compartment. Follow instructions on instruction plate (figure 4–21) for seat and step operation.

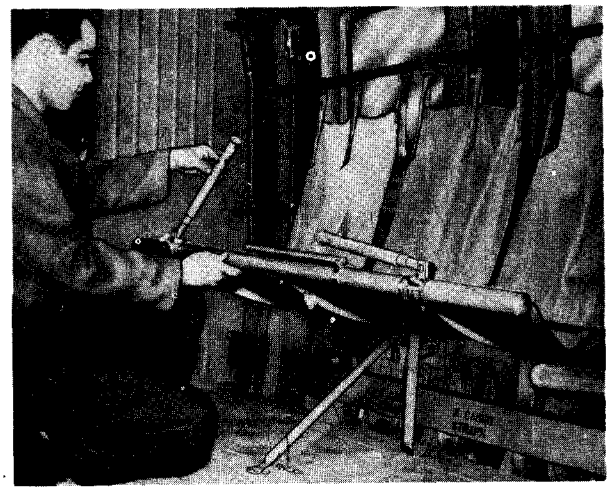


Figure 4–16. Seat Legs Folded on Forward Seat Tube of 12-Man Troop Seat

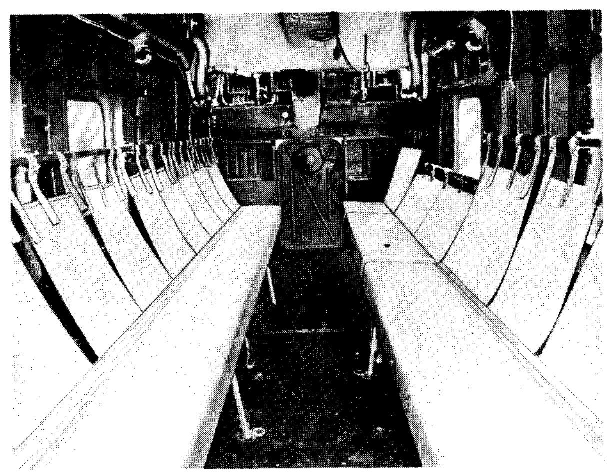


Figure 4–17. 18-Man Troop Seats

f. Stow release handle under snap flap on center of seat. (See figure 4–22.)

4–23. FOLDING 18-MAN TROOP SEATS.

Note

All seats may be folded against cargo compartment wall with exception of seat-step combination which can readily be removed if space is required.

a. Press in ears on lower ends of legs (figure 4–9) and pull up, releasing legs from tie-down fitting studs in cargo floor.

b. Fold seats against cargo compartment wall (figure 4–23) and hook securing strap, located on bottom of seat, to troop seat back support tube (figure 4–24).

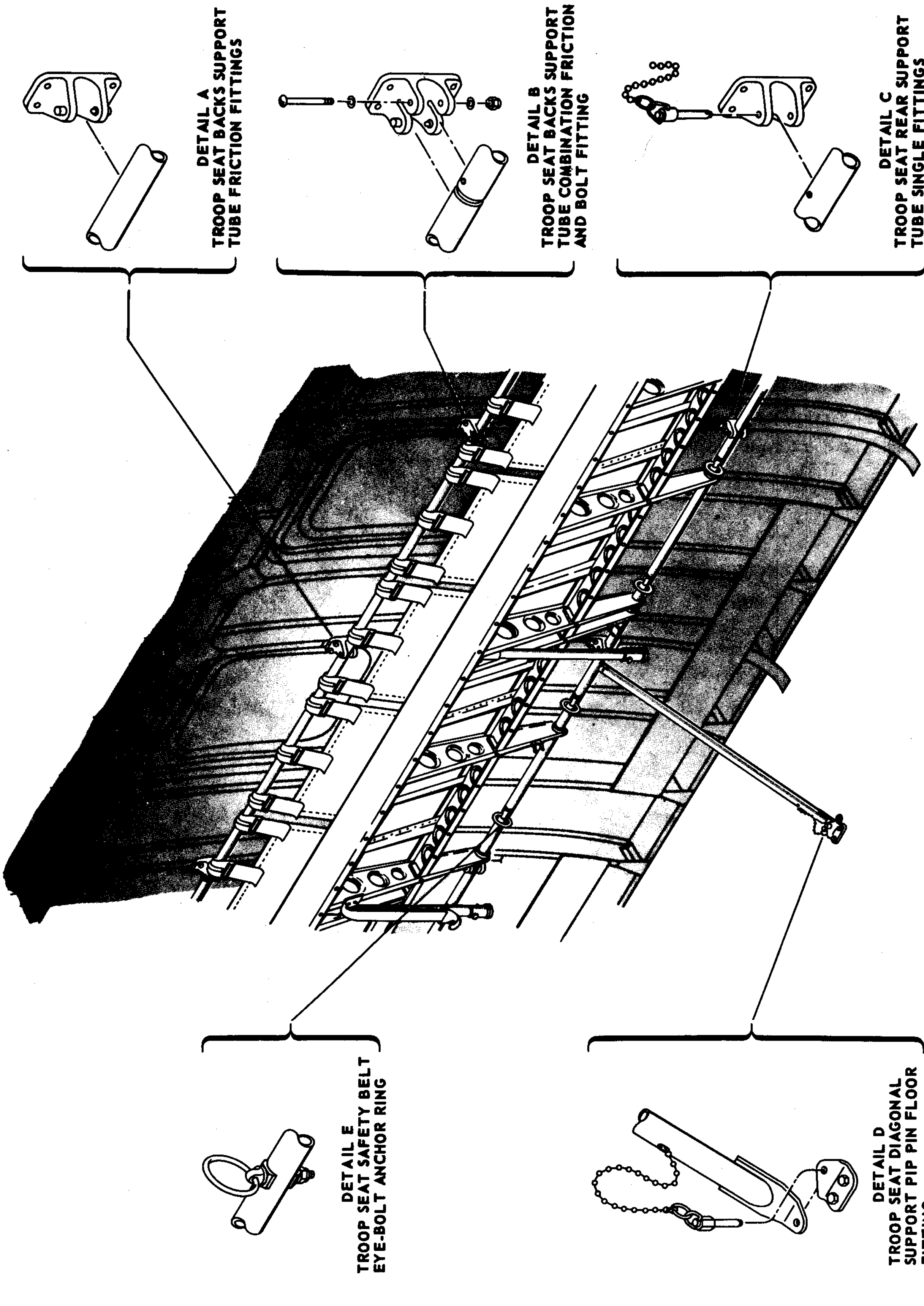


Figure 4–18. 18-Man Troop Seat Installation

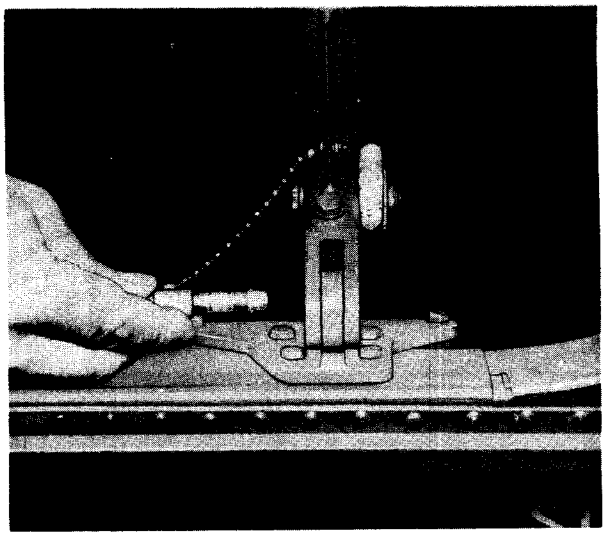


Figure 4–19. Installing Push-Button Pin in Troop Seat Step and Cargo Floor Hinge Fittings

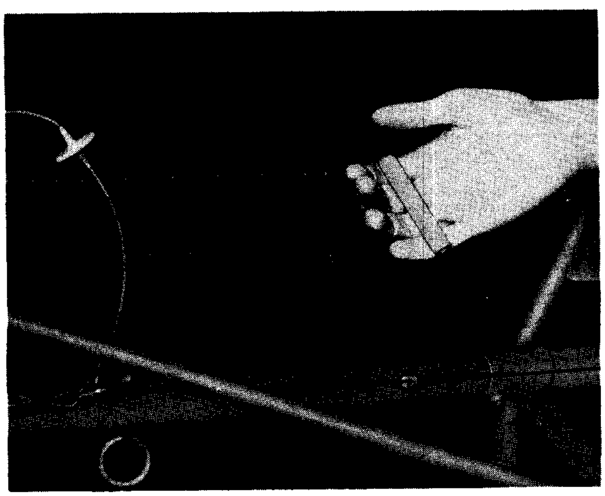


Figure 4–20. Pulling Release Handle to Release Seat Step

INSTRUCTIONS FOR OPERATING SEAT-STEP
UNSNAP FLAP OVER RELEASE HANDLE. PULL HANDLE TO DISENGAGE AND PUSH SEAT OUTBOARD. DO NOT LET SEAT SLAM.
RETRACT BY PULLING RELEASE CABLE TO DISENGAGE SEAT-STEP AND WITH OTHER HAND PULL BUNGEE CORD TO RETURN INTO AIRCRAFT.

Figure 4–21. Combination Troop Seat and Step Fold Instruction Plate

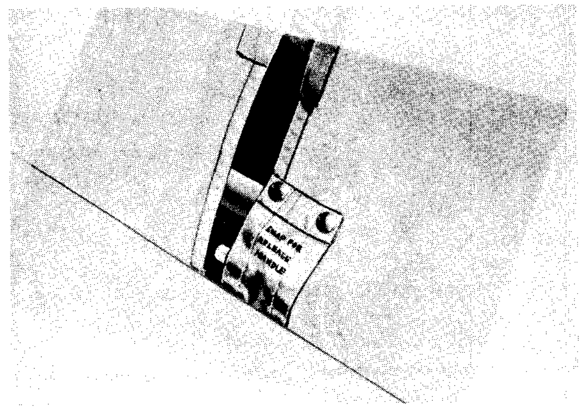


Figure 4–22. Seat Step Release Handle Stowed

Figure 4–23. Folding 18-Man Troop Seats

c. Remove pip pin (detail D, figure 4–18) securing lower end of diagonal support tube to cargo floor fitting (figure 4–25).

d. Remove diagonal support tube from seat rear support tube.

e. Stow diagonal support tube in spring clips located on bottom of seat (figure 4–26).

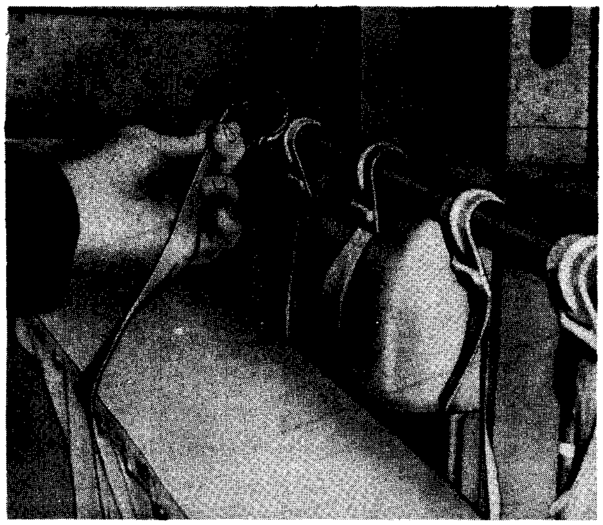


Figure 4-24. Securing 18-Man Troop Seats

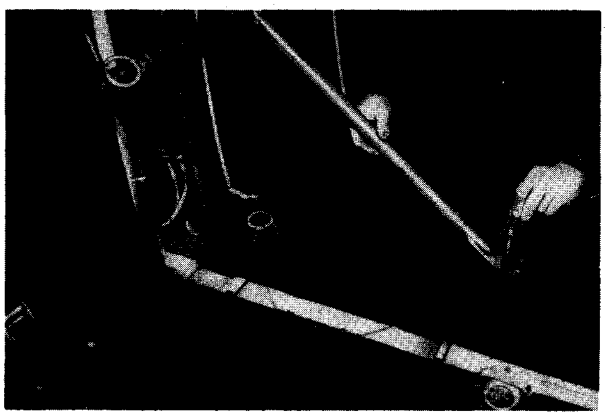


Figure 4-25. Removing Pip Pin from Cargo Floor Fitting and Diagonal Support Tube

4-24. SAFETY BELTS.
(See figure 4-27.)

4-25. INSTALLATION.

a. Clip safety belt assembly to anchor rings. (See figure 4-4.)

b. Install a right-hand and left-hand safety belt assembly so that each seat has one complete safety belt.

Note

Attach left-hand assembly of safety belt containing buckle (3, figure 4-28) to anchor ring on left side of troop seat. (See figure 4-4.)

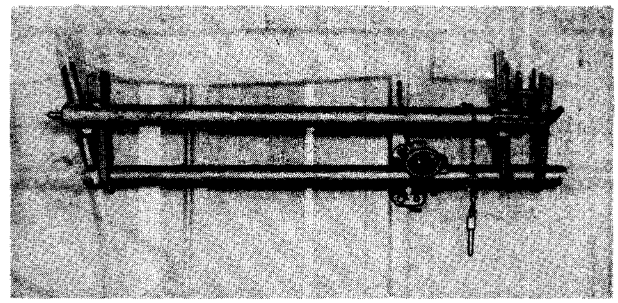


Figure 4-26. Diagonal Support Tube Stowed

Figure 4-27. Troop Seat Safety Belt (Typical)

4-26. OPERATION.

a. Position safety belt across lap and slide engaging bar (2, figure 4-28) into buckle (3) of safety belt. (See figure 4-27.)

b. Tighten safety belt by pulling on adjusting end of left-hand belt assembly (5, figure 4-28).

Note

To make belt longer, push belt length adjustment knob (4) forward and pull adjusting belt (5) through buckle.

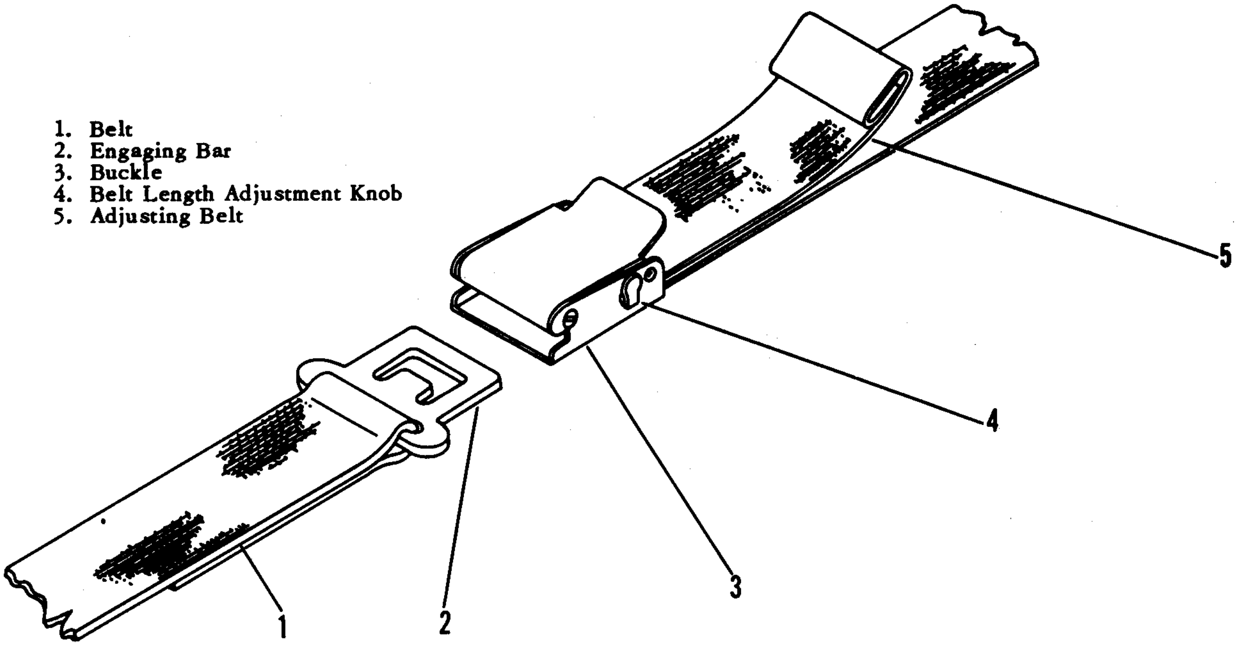


Figure 4–28. Troop Seat Safety Belt Assembly

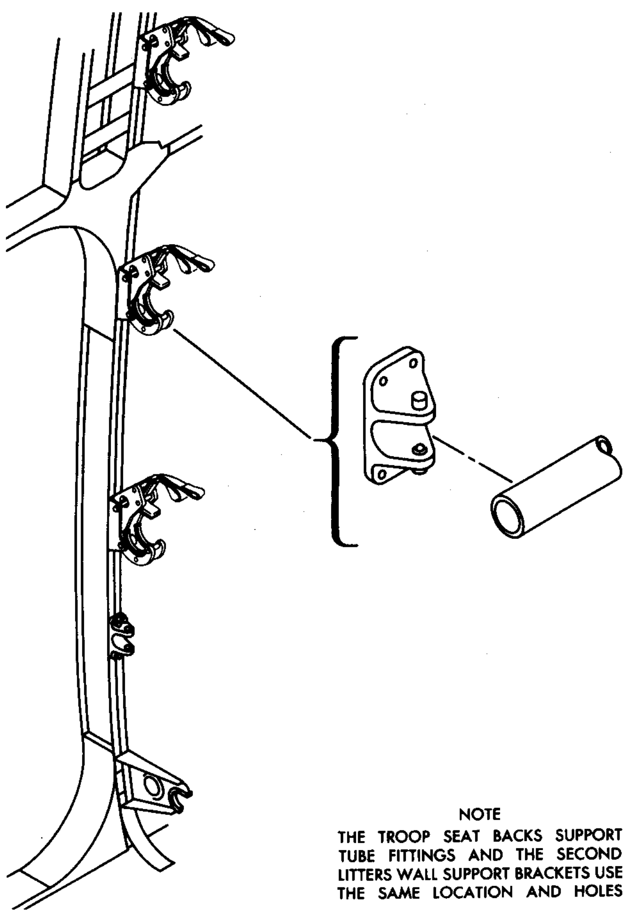


Figure 4–29. Litter Support Wall Bracket Installation

c. To release safety belt, pull out on left side of buckle. (See figure 4–28.)

4–27. LITTER SUPPORT INSTALLATION.

4–28. INSTALLATION OF LITTER SUPPORT WALL BRACKET. Four litter support wall brackets that support the second from the top litters are not installed on the helicopter at all times as are the other 12. These brackets are installed in the same locations as the troop seat backs support tube fittings. These fittings must be removed before the litter support wall brackets can be installed.

a. Remove four bolts, washers, and nuts securing troop seat backs support tube fitting from cargo compartment wall.

b. Remove litter support wall brackets from utility stowage bag. (Refer to paragraph 3–31.)

c. Install wall brackets at same location from which troop seat backs support tube fittings have been removed. (See figure 4–29.)

4–29. INSTALLATION OF THE LITTER SUPPORT STRAPS.

a. Remove all litter support straps from their stowage shelves. (See figure 3–4.)

b. Attach upper end of litter strap to ceiling (detail C, figure 4–30) by inserting strap through ceiling tie-down fitting and follow through by inserting strap into strap buckle. (See figure 4–31.)

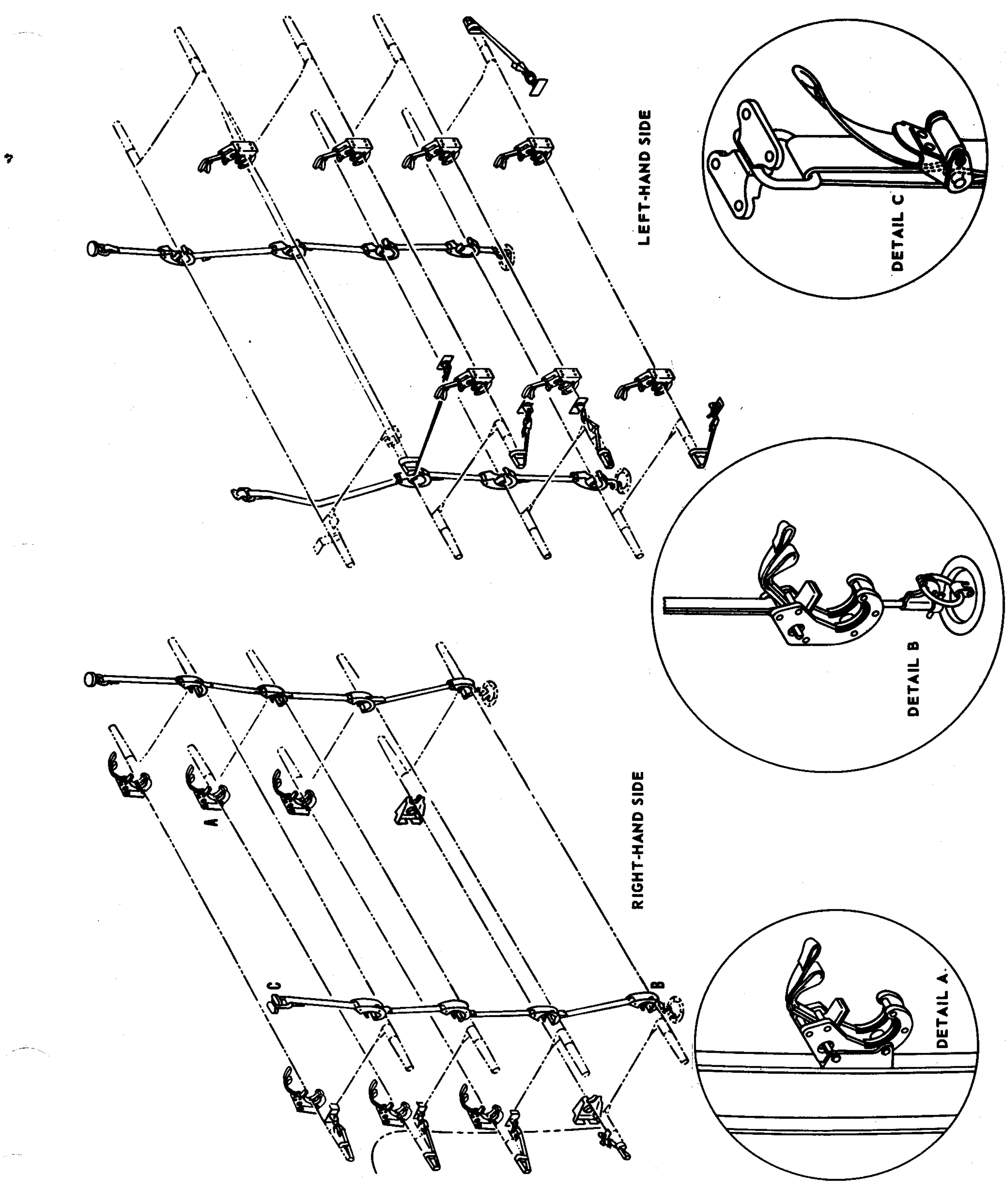


Figure 4–30. Litter Installation

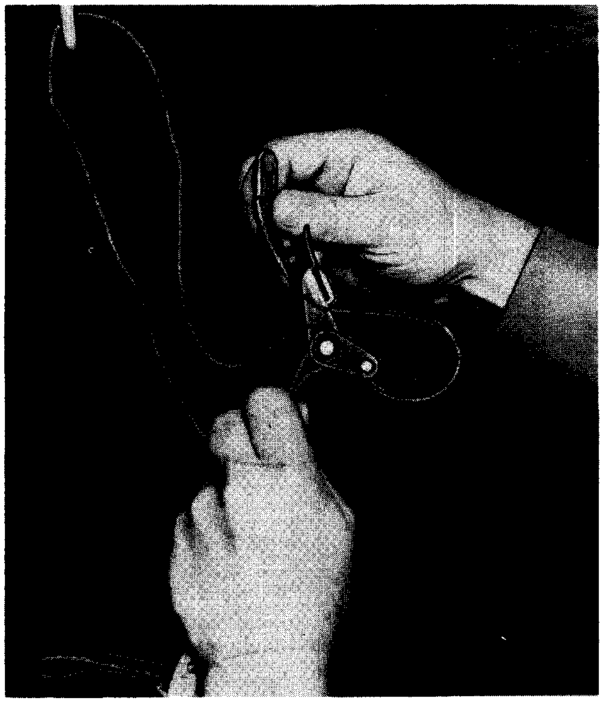


Figure 4-31. Inserting Litter Support Strap Through Ceiling Tie-Down Fitting and Strap Buckle

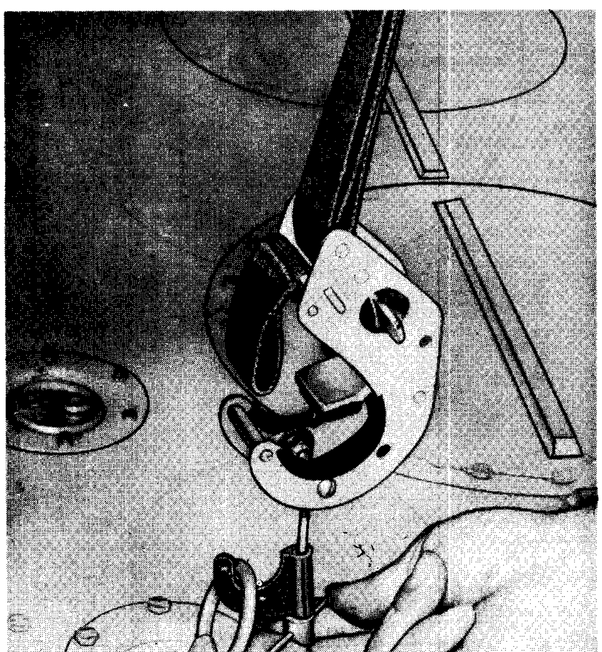


Figure 4-32. Securing Bottom Litter Support Strap Bracket Tie-Down Hook Into Cargo Floor Tie-Down Fitting

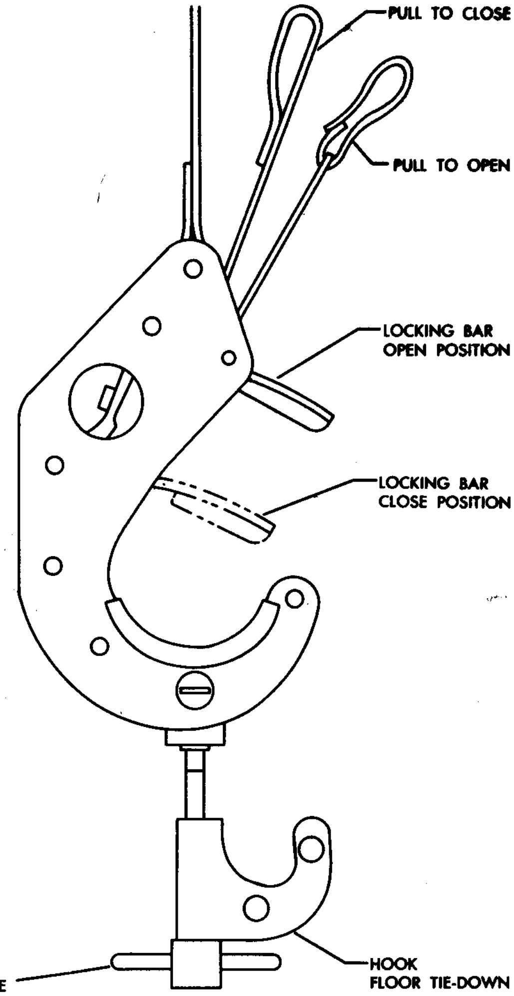


Figure 4-33. Bottom Litter Support Bracket

Figure 4-34. Placing Litter on Litter Support Wall Bracket First

c. Engage bottom litter support strap bracket tie-down hook into cargo floor tie-down fitting. (See figures 4-32 and 4-33) Check and/or adjust for proper length.

d. Open all brackets to prevent delay during litter loading. (See figure 4–34.)

Note

Disengage hook on bottom litter support strap bracket before loading litter. After completion of loading litters, reengage hook into cargo floor tie-down fitting and take up slack in strap by turning T handle at bottom of bracket.

4–30. LITTER LOADING.

Note

Prior to loading, check patient's wound to better determine best loading arrangement to facilitate emergency inflight treatment.

a. Load left tier of litters first.

b. Load litters from top to bottom.

4–31. LOADING LITTERS ON LITTER BRACKETS.

a. Place outboard side of litters on litter support wall brackets. (See figure 4–34.)

b. Place inboard side of litter on corresponding litter support bracket on litter support straps as shown in figure 4–35.

c. Pull web torque on litter support bracket (figure 4–36) to lock locking bar on litter support bracket.

d. Tighten litter support strap after last litter in row is loaded, using T handle in bottom strap support litter bracket. (See figure 4–32.)

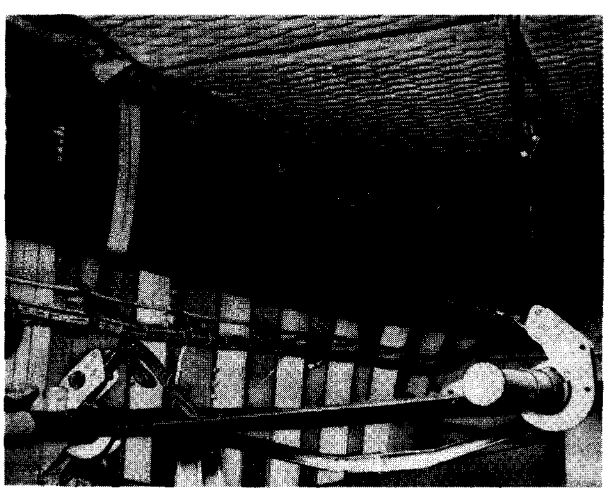


Figure 4–35. Top Litter Installed

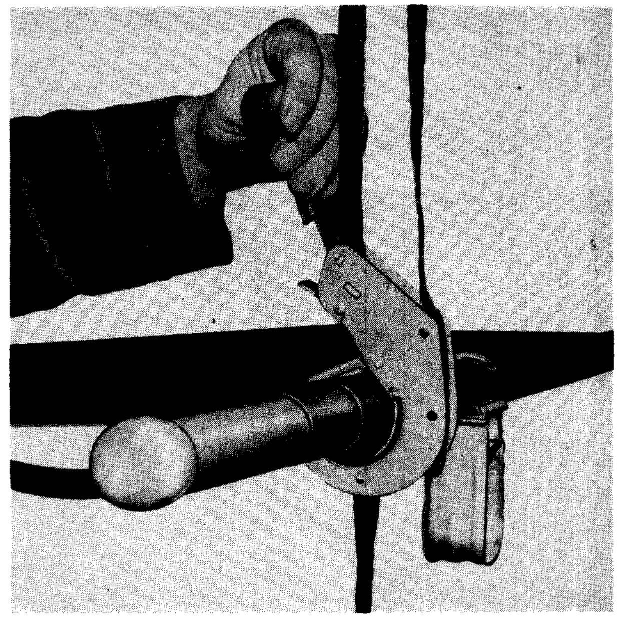


Figure 4–36. Pulling Outboard Web Tongue to Lock Litter Support Bracket Locking Bar

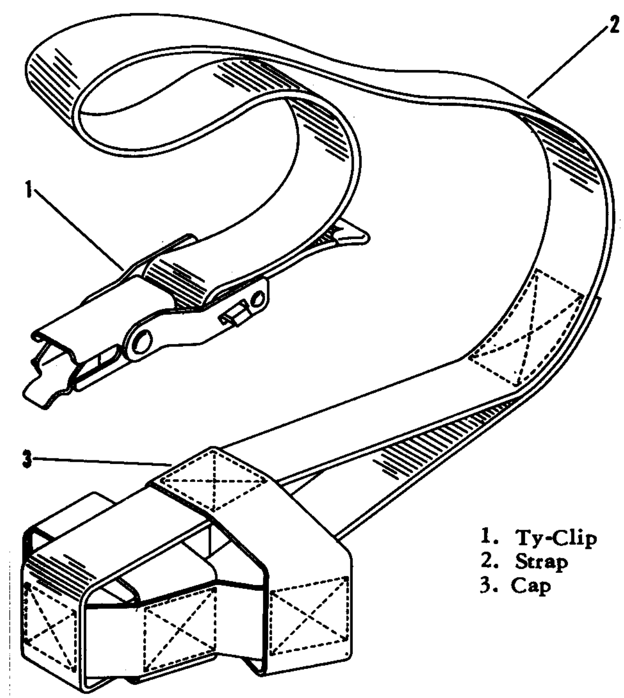


Figure 4–37. Litter Retaining Cap Assembly

4–32. INSTALLATION OF LITTER RESTRAINING CAP ASSEMBLY. (See figure 4–37.)

a. Install litter restraining cap (3) on litter handle. (See figure 4–38.)

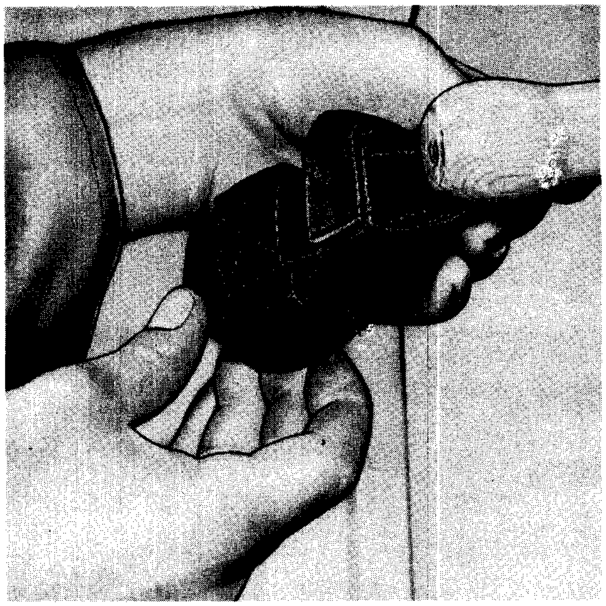


Figure 4–38. Installing Litter Retaining Cap Assembly

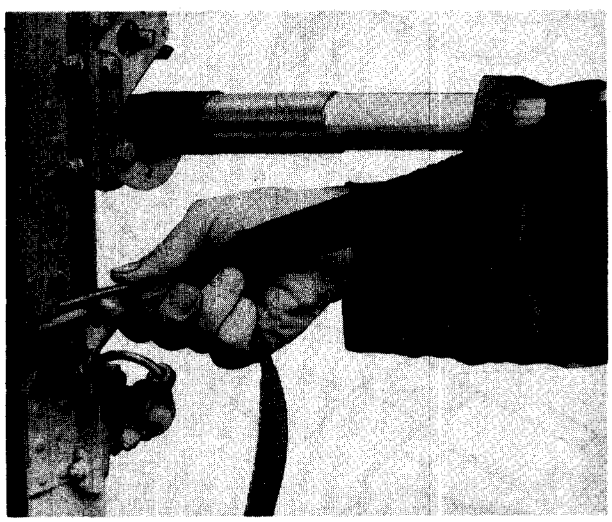


Figure 4–39. Securing Litter Retaining Cap Assembly Ty-Clip to Wall Tie-Down Fitting

b. Fasten litter restraining cap assembly ty-clip (1, figure 4–37) to cargo compartment wall fie-down fitting. (See figure 4–39.)

c. Adjust litter restraining cap assembly for proper length. (See figure 4–40.) Secure litter in bracket. (See figure 4–41.)

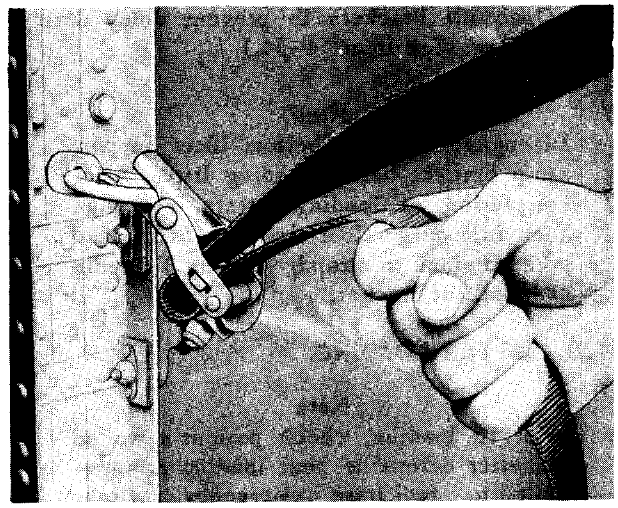


Figure 4–40. Adjusting Retaining Cap Assembly for Proper Length

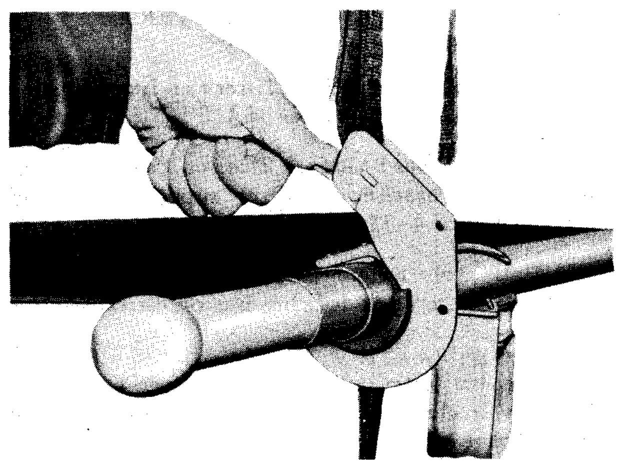


Figure 4–41. Pressing Cam Down to Open Litter Locking Bar on Litter Support Strap Bracket

4–33. CARGO LOADING.

4–34. PREPARATION OF HELICOPTER FOR CARGO LOADING.

4–35. CHECKLIST.

a. Set parking brakes.

b. Check landing gear for proper extension of strut.

c. Open cargo loading door.

d. Fold, stow, or remove, as required, troop seats and/or litters.

e. Clean cargo compartment.

f. Check that cargo device stowage compartments contain proper number of A-1A tie-down devices.

g. Check that emergency equipment is installed and in working order.

4-36. CARGO SIZE LIMIT CHART.
(Refer to figure 4-2, sheet 10, Chapter 12.)

4-37. The cargo size limit chart shows the largest size object that can be loaded into the cargo compartment through the cargo door.

4-38. PREPARATION OF CARGO FOR LOADING.

4-39. LOADING DATA. Prior to loading the cargo, the following data should be assembled by the loading crews:

a. The weight of the individual items of cargo.

b. The overall dimension of the cargo. If there is a question as to whether or not an item of cargo can be loaded through the cargo door of the helicopter, refer to figure 4-2, sheet 10, Chapter 12.

c. The amount of shoring required. For the amount of shoring required, refer to paragraph 5-12.

4-40. CHECKLIST.

a. Assemble cargo to be loaded and obtain necessary loading data.

b. Secure any loose ends on cargo.

c. Be sure all wooden boxes are nailed tight and secured.

d. Boxes are to be loaded in accordance with any directions or arrows stamped on them.

SECTION V

GENERAL INSTRUCTIONS FOR LOADING, SECURING AND UNLOADING CARGO

5–1. GENERAL.

5–2. This section is intended to instruct the loading crew on how to place and restrain the cargo in the helicopter.

5–3. LOADING FUNDAMENTALS.

5–4. There are three items that must be considered when loading the helicopter with cargo.

a. Weight – Cargo weight must remain within the carrying capacity of the helicopter.

b. Balance – Cargo must be arranged so that the helicopter's center-of-gravity is maintained.

c. Restraint – Cargo must be restrained from undesired movements.

5–5. WEIGHT.

5–6. Each helicopter is weighed from time to time to determine its empty or basic weight. The design of the helicopter permits computation of its maximum allowable gross or loaded weight. To find the weight of cargo that may be carried on any particular mission, the basic helicopter weight together with the weights of the required fuel, oil, crew, and other essentials must be added and the result subtracted from the allowable gross weight. The weight of cargo that may be carried is further restricted by the strength of the cargo floor.

5–7. BALANCE.

5–8. As in every object, the helicopter has a point about which it will balance. This is the center-of-gravity. Any item which is added or removed from the helicopter causes a change in the balance of the helicopter forward or aft. If the cg shifts too far forward or too far aft, the helicopter will develop unsafe flight characteristics. (See figure 5–1.) Cargo must be loaded in such a way that the cg of the helicopter is not exceeded. Fortunately, the CH-34 helicopter has been designed in such a manner that in most instances there is no difficulty in loading cargo so that the cg of the helicopter falls within the operating limits specified in Chapter 12, Weight and Balance Computation.

5–9. CARGO CENTER-OF-GRAVITY PLANNING.

5–10. All cargo loads should normally be planned before being actually loaded into the helicopter. The degree of load planning will vary with each operation depending upon the cargo to be loaded and the experience of the loading personnel. Basic factors that must be considered in the planning the placement of the cargo are as follows:

a. Cargo must be loaded so that center-of-gravity of loaded helicopter remains within operating limits specified in Chapter 12, Weight and Balance Computation.

b. Cargo must be arranged to permit free access to emergency exits and equipment while in flight.

c. Cargo must be loaded without exceeding cargo floor strength or damage to cargo floor will result. (Refer to paragraph 5–12.)

d. Bulk cargo must be properly stacked to prevent damage to fragile items.

e. Cargo should be arranged to permit rapid and secure tie-down of all items.

f. Boxes and crates should be loaded in accordance with any instructions marked on them.

5–11. CARGO LOADING DATA LINE. (See figure 5–2.) The cargo loading data line is located at station 154 and is marked by a white line on the cargo floor and the left-hand compartment wall. If a cargo load is distributed, weightwise, equally on both sides of this line, the cg of the helicopter will be within the limits specified in Chapter 12, Weight and Balance Computation.

Note

Cargo must be equally distributed about cargo loading data line so that weight of cargo on both sides of line is approximately equal. It does not make any difference if number of items on both sides of line is different.

5–12. DETERMINING AMOUNT OF SHORING.

5–13. Shoring is the laying of planks, plywood, or any other material of 1/4-inch thickness or more

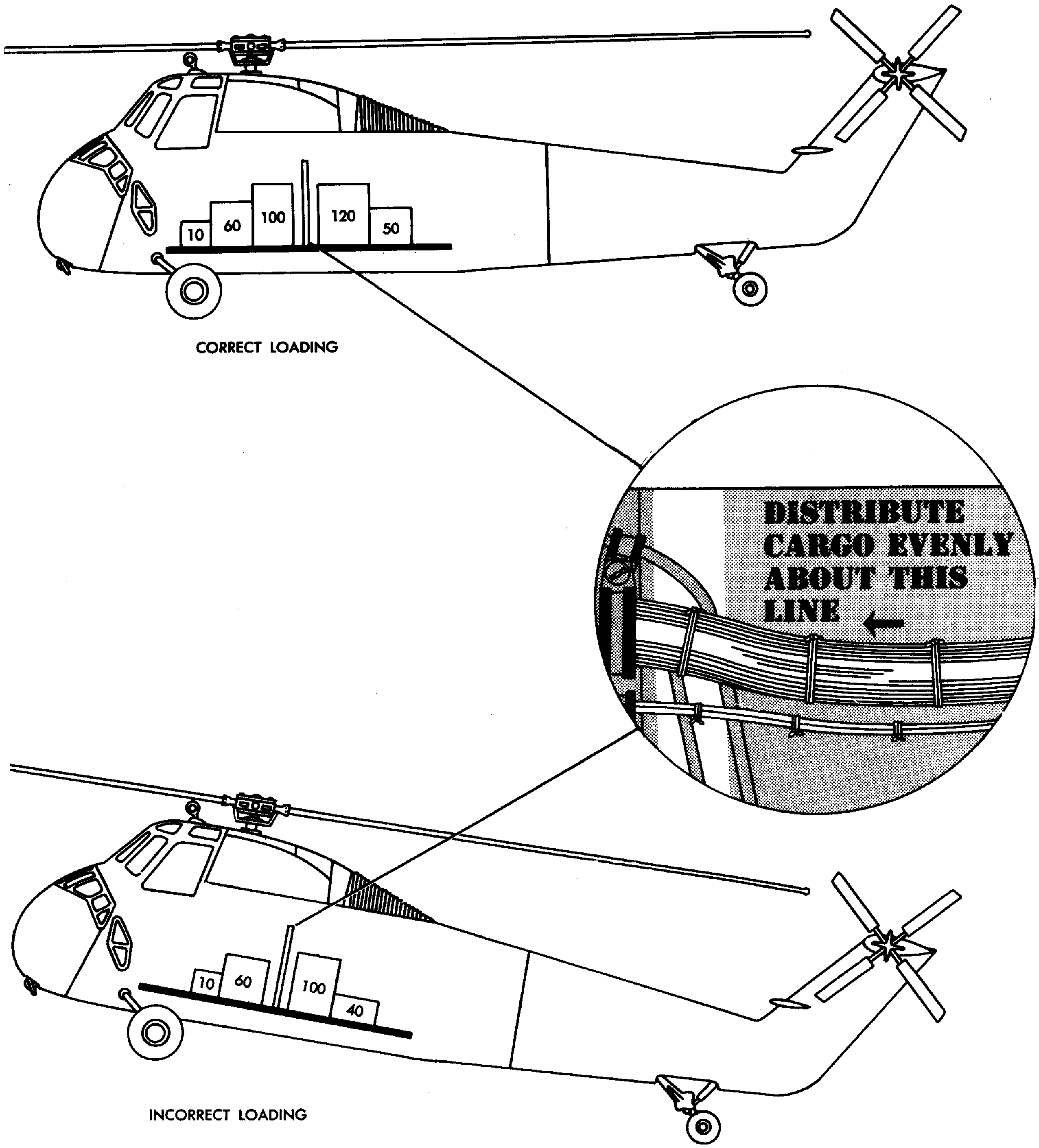
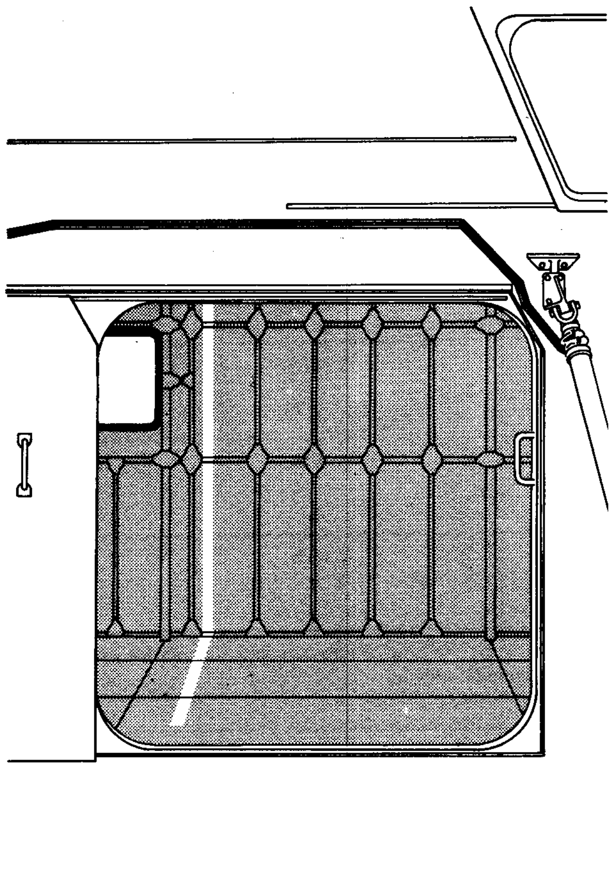


Figure 5–1. Effect of Cargo on Center-of-Gravity

on the cargo floor to protect the cargo floor and/or to spread the contact pressure of cargo. Some items of cargo may have contact with the cargo floor with an area that is small in comparison with its weight. Cargo on casters, legs, runners, or blocks usually exceed the floor limitation and must be shored. Shoring comes under two headings; shoring for weight distribution and shoring for floor protection.

5–14. SHORING FOR WEIGHT DISTRIBUTION. (Refer to table 5–1.) The weight of cargo may be distributed by the use of shoring. Shoring may be wooden planks, sheets of plywood, or any other



NOTE
CARGO MUST BE EVENLY DISTRIBUTED ABOUT THE CARGO LOADING DATA LINE SO THAT THE WEIGHT OF THE CARGO ON BOTH SIDES OF THE LINE IS APPROXIMATELY EQUAL. IT DOES NOT MAKE ANY DIFFERENCE IF THE NUMBER OF ITEMS ON BOTH SIDES OF THE LINE IS DIFFERENT.

Figure 5–2. Cargo Loading Data Line

rigid material that will resist bending under weight and distribute the contact pressure area of the cargo resting on it. The use of shoring will sometimes make the difference between being able to carry a load or not. It is recommended that plywood sheets be used when possible.

5–15. SHORING FOR FLOOR PROTECTION. (Refer to table 5–1.) Before any dollies or cargo with legs or blocks can be loaded into the helicopter on the cargo floor, the floor must be shored for protection. No wheels should be rolled on the cargo floor without shoring.

5–16. CONTACT PRESSURE. Contact pressure is calculated for heavy items in order to determine whether a load can be carried inside the helicopter without exceeding the strength of the cargo floor. The contact pressure of skidded boxes and crates, etc, is determined by dividing the weight of the item by the area of the cargo floor the item covers. The contact pressure of items which are supported by wheels, casters, rollers, legs, etc, which concentrate the load at several points on the cargo floor, is determined by dividing the weight of the item by the area of the number of points which support the item.

5–17. SECURING LOADS.

5–18. RESTRAINT CRITERIA.

5–19. Cargo in the helicopter is subjected to forces resulting from rough air, acceleration, autorotation, vibration, rough landings, crash landings, etc. These forces act more strongly in some directions than in others, and tend to shift the cargo unless it is firmly fastened. Since both the helicopter and the cargo move rapidly during normal operations, the cargo will tend to keep moving rapidly in the same direction if the helicopter is suddenly slowed by change of pitch, landing on soft ground, or stopped by a crash landing. This direction of force is the strongest that is likely to act on the cargo, but the cargo must also be secured against other forces trying to move it aft, from side to side (laterally), or up off the cargo floor (vertically). The amount of force that must be used to keep the cargo from moving in any direction is called restraint and is usually expressed in units of the force of gravity, or G's. The following are the units of the force of gravity or G's required to restrain cargo in the four directions.

Forward	4.0 G's
Aft	2.0 G's
Lateral	1.5 G's
Vertical	1.0 G

In all four cases, this actually means that the force exerted by the object or cargo to be restrained may be as much as its normal weight times the number of G's of the restraint criterion. For example, an object weighing 1000 pounds may, if the helicopter is suddenly stopped, tend to move aft with a force of 2000 pounds, laterally with a force of 1500 pounds, or vertically upward with a force equal to its weight. For the object to be safely carried, the restraint applied must be equal to, or greater than, these amounts.

5–20. NOMENCLATURE. Any restraint is given the name of the direction in which it is meant to keeps the cargo from moving forward. Aft restraint keeps it from moving aft. Lateral restraint keeps it from moving from one side to the other. Vertical restraint keeps it from moving upward only, the downward restraint being supplied by the cargo floor.

TABLE 5-I

RULE OF THUMB FOR SHORING

SHORING FOR WEIGHT DISTRIBUTION

TYPE OF LOAD	SHORING REQUIRED FOR FLIGHT AND LOADING (THICKNESS)
Flat bottom boxes, crates, and skidded cargo with long skids up to allowable pressures of 200 pounds per squar foot.	None
Flat bottom boxes, crates, and skidded cargo with long skids over allowable pressure of 200 pounds per square foot.	1 inch
Skidded cargo with short skids (less than 18 inches) and contract pressure over allowable pressure of 200 pounds pre squar foot.	1 inch
Cargo loads with wheels, legs, casters, etc, that concentrate load on cargo floor at several points with pressure up to 200 pounds per support.	1 inch
Cargo loads with wheels, legs, casters, etc, that concentrate load on cargo floor at several points with pressure over 200 pounds per support.	1 inch for the first 200 pounds and 1/4 inch for each 50 pounds added.

SHORING FOR FLOOR PROTECTION

TYPE OF LOAD	SHORING REQUIRED FOR FLIGHT AND LOADING (THICKNESS)
Any load that has projections which can dig into cargo floor.	Minimum of 1/4 inch of plywood.

5–21. RESTRAINT DEVICES. (See figure 5–3.) The helicopter is equipped with a number of tie-down devices which are used to apply the required restraint to the cargo. When correctly attached to the cargo and to the cargo floor, these devices will keep the load from moving in any direction within the helicopter.

5–22. STRENGTH LIMITATIONS OF THE TIE-DOWN DEVICES. A tie-down device will furnish restraint equal to its rated strength when the load is applied parallel to its length; you will find that the device is fastened at an angle in direction to the load. As this angle varies so does the percent of restraint furnished by the tie-down device in any direction. The lowest angle that can be attained is 15 degrees due to the will of the tie-down fitting. For the amount of restraint available at various angles, refer to table 5-II.

5–23. METHODS OF RESTRAINING CARGO. There are two basic methods of applying tie-downs to restrain cargo. (Refer to paragraph 5–24 and 5–25.) The method used depends upon whether or not the cargo has tie-down provisions.

5–24. CARGO WITH NO TIE-DOWN PROVISIONS. This type of cargo is restrained by passing the tie-down devices over and/or around the cargo and attaching both ends of the tie-down device to the tie-down fittings in the cargo floor.

5–25. CARGO WITH TIE-DOWN PROVISIONS. This type of cargo is restrained by attaching one end of the tie-down device to the tie-down fittings in the cargo floor and the other end to the cargo.

5–26. RESTRAINING CARGO WITH NO TIE-DOWN PROVISIONS. Many cargo loads carried in the helicopter will consist of a variety of boxes, crates, etc. This type of cargo must be secured by passing tie-down devices over and around the cargo as shown in figure 5–4. When cargo is restrained in this manner, there are three factors which must always be kept in mind. (Refer to paragraphs 5–27 through 5–29.)

5–27. AMOUNT OF RESTRAINT. A tie-down device placed around an item of cargo will provide restraint equal to the effective strength of the strap in the direction it prevents the cargo from moving. This means, then, an A-1A tie-down device, applied as in

A. INSERT HOOKS IN THE TIE-DOWN RINGS.
B. PULL FREE END UNTIL STRAP IS TIGHT.
C. PUSH LEVER DOWN TO LOCK AND TENSION.

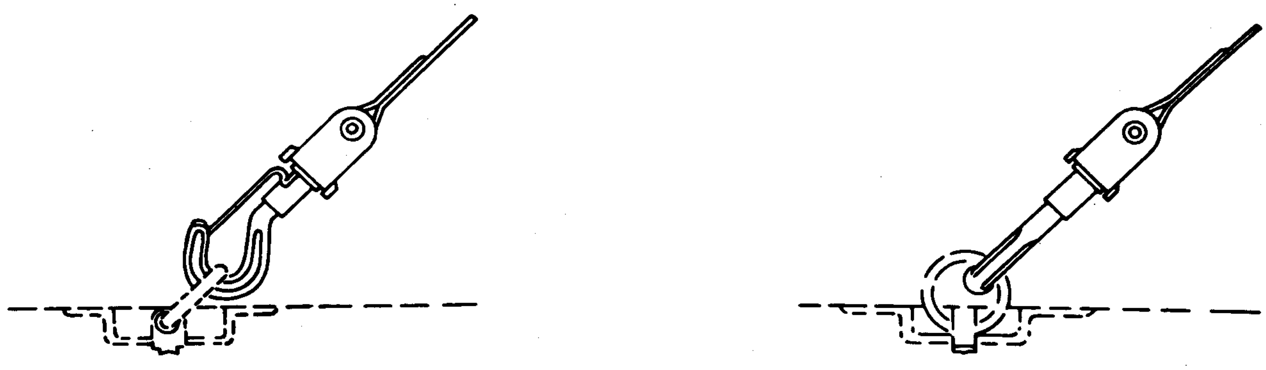


Figure 5–3. Application and Operation of Tie-Down Devices

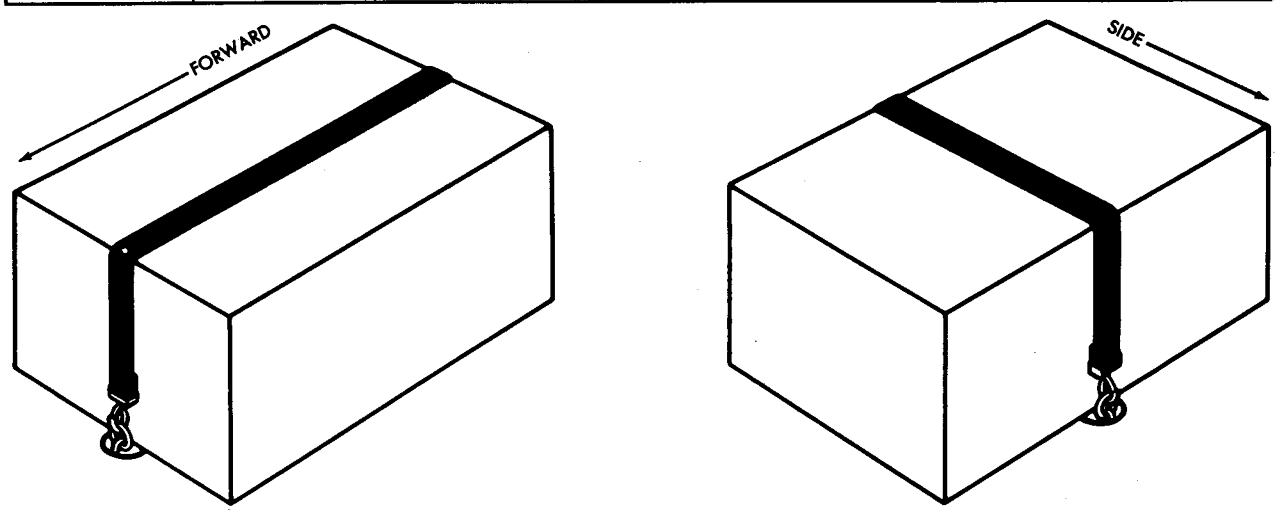
detail A, figure 5–4, will provide 1250 pounds of restraint in the forward, vertical, and aft directions since it will prevent the cargo from moving in these directions. The tie-down device applied across the front of the cargo shown in detail A, figure 5–5, will only provide restraint in the forward direction since this is the only direction in which it really prevents the cargo from moving. The lateral and vertical restraint from this device would be nil since the cargo can readily move in these directions. Extreme care must be taken in applying tie-down devices as shown in detail A, figure 5–5. Unless there is a projection of some kind on the cargo, the device shown in detail B, figure 5–5, is unsatisfactory, since it would slip down to the floor and free the cargo under load. One further way of preventing this from happening is to apply an extra device as shown in detail D, figure 5–6.

5–28. LENGTH AND TIE-DOWN ANGLE OF THE TIE-DOWN DEVICES. A tie-down device generally should always be as short as possible and follow as closely as possible the contour of the cargo it is securing to minimize slippage. When tie-down devices are passed over cargo from side to side, as shown in detail B, figure 5–5, the tie-down should be as close to 90 degrees as the floor fittings will permit. This is also true of the first two tie-down devices (if there are two) which pass over the cargo in the fore-and-aft direction. If there are more than two devices in the fore-and-aft direction, the tie-down angle of the additional devices on the aft side of the cargo should be changed to 45 degrees as shown in figure 5–7 to obtain additional protection against any tendency the cargo may have to tumble forward. This procedure is particularly important when tying down

TABLE 5–II

RESTRAINT TABLE FOR 1250 – LB CAPACITY FITTING

SIDE ANGLE	VERT ANGLE	15°	30°	45°	60°	75°	90°
	VERT REST	325	625	885	1085	1210	1250
0°	AFT FWD	1295	1085	885	625	325	0
	SIDE	0	0	0	0	0	0
15°	AFT FWD	1165	1045	855	605	315	0
	SIDE	315	280	230	165	85	0
30°	AFT FWD	1045	940	765	540	280	0
	SIDE	605	540	445	315	165	0
45°	AFT FWD	855	765	625	445	230	0
	SIDE	855	765	625	445	230	0
60°	AFT FWD	605	540	445	315	165	0
	SIDE	1045	940	765	540	280	0
75°	AFT FWD	315	280	230	165	85	0
	SIDE	1165	1045	855	605	315	0
90°	AFT FWD	0	0	0	0	0	0
	SIDE	1295	1085	885	625	325	0



A

THIS A-1A 1250-POUND TIE-DOWN DEVICE WILL PROVIDE 1250 POUNDS OF RESTRAINT IN THE FORWARD, VERTICAL, AND AFT DIRECTION.

B

THIS A-1A 1250-POUND TIE-DOWN DEVICE WILL PROVIDE 1250 POUNDS OF RESTRAINT IN THE LATERAL AND VERTICAL DIRECTION.

Figure 5–4. Restraint in Three Directions

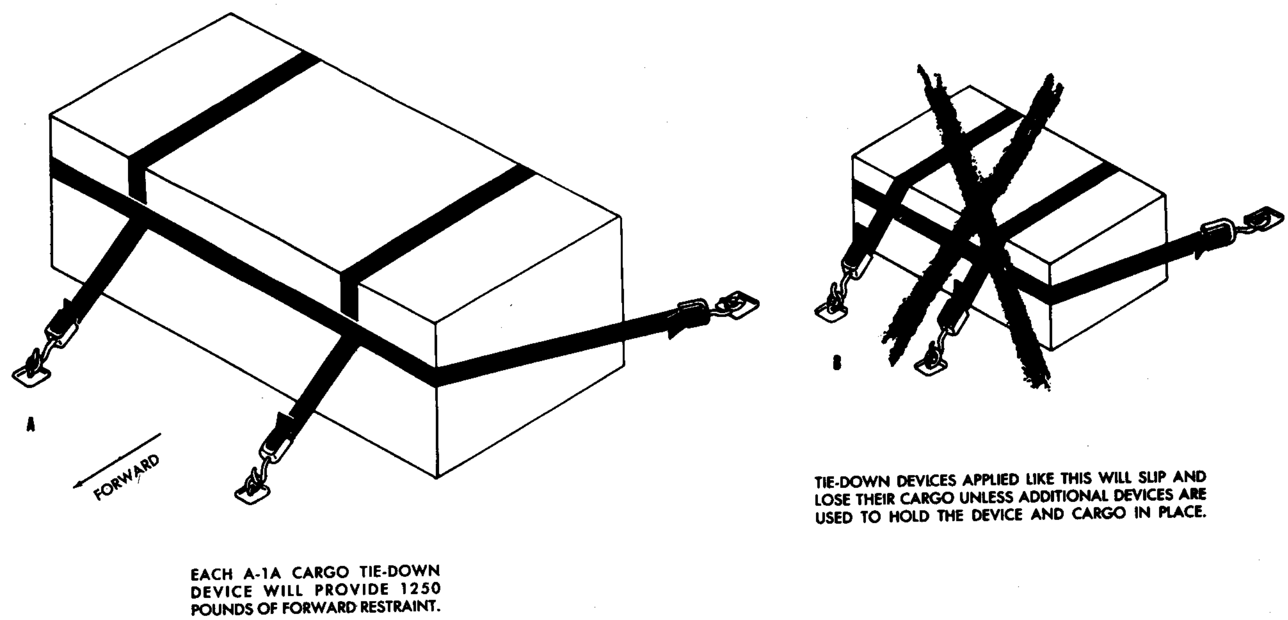


Figure 5–5. Forward Restraint Only

tall items and composite cargo loads consisting of several boxes stacked on top of one another. In arranging composite loads, cargo should not be stacked so that it is top-heavy. The height of a composite load should not be greater than its length in the longitudinal direction if it can be avoided.

5–29. SHIFTING OF CARGO. Since the tie-down devices are not actually attached to the cargo, care must be taken to insure that the load cannot slip out from under the tie-down device. This is especially true when several items are tied down together. After the proper number of tie-down devices have been applied to comply with the restraint criteria, the load should always be checked to see if any part of it can slip free. In many instances, where several items are tied down together, it may be necessary to add additional tie-down devices to completely secure the load.

5–30. RULES FOR APPLYING TIE-DOWNS TO CARGO WITH NO TIE-DOWN PROVISIONS.

a. Rule 1. If the item(s) of cargo to be tied down as one load is 1250 pounds or less, see figure 5–6 to determine the minimum number of tie-downs required to provide restraint.

b. Rule 2. If the load is over 1250 pounds and consists of a single item, follow the procedure outlined in the sample problem. (Refer to paragraph 5–31.)

c. Rule 3. If the load is over 1250 pounds, and if it is a composite load consisting of several items, separate the load into two smaller loads. If this is not possible, follow the procedure outlined in the sample problem. (Refer to paragraph 5–31.)

d. Rule 4. If sufficient tie-down devices are applied over the top of the cargo to provide forward and lateral restraint, then vertical and aft restraint will automatically be provided. If tie-down devices are applied across the cargo as shown in figure 5–8, then the restraint in each direction should be checked if there is any question.

e. Rule 5. After applying the tie-down devices required for minimum restraint, check the load to determine if additional tie-down devices are required to prevent the load from shifting. Composite loads will almost always require additional tie-down devices in the lateral direction.

5–31. SAMPLE PROBLEM. Secure cargo with no tie-down provisions. The composite load shown in figure 5–8 weighs 500 pounds.

5–32. PROBLEM: How many tie-down devices are required to properly secure the load?

Note

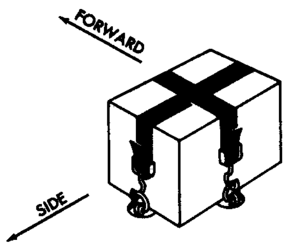
The minimum number of tie-down devices required to restrain the cargo can be obtained directly from figure 5–9. This problem will be worked out in detail, however, in order to illustrate the general method.

5–33. SOLUTION:

a. Step 1. Determine the maximum amount of forward and lateral restraint necessary to restrain

THIS CHART PROVIDES A SIMPLE METHOD FOR DETERMINING THE MINIMUM NUMBER OF TIE-DOWN DEVICES REQUIRED TO MEET THE RESTRAINT CRITERIA FOR DIFFERENT CARGO WEIGHT. THE TIE-DOWN PATTERNS ILLUSTRATED ARE APPLICABLE TO SINGLE AS WELL AS COMPOSITE LOADS, HOWEVER, FOR COMPOSITE LOADS ADDITIONAL TIE-DOWN DEVICES WILL ALMOST ALWAYS BE REQUIRED TO PREVENT THE LOAD FROM SLIPPING. FOR CARGO LOADS HEAVIER THAN THOSE SHOWN BELOW FOLLOW THE PROCEDURE OUTLINED IN THE SAMPLE PROBLEM, FIGURE 5-12.

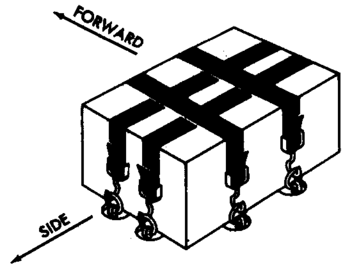
0 TO 250 POUNDS



TIE-DOWN DEVICES REQUIRED
FORWARD RESTRAINT -1
SIDE OR LATERAL RESTRAINT -1
AFT RESTRAINT -1

A

250 TO 500 POUNDS



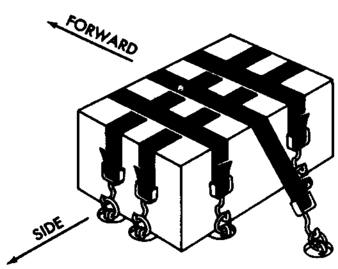
TIE-DOWN DEVICES REQUIRED
FORWARD RESTRAINT -2
SIDE OR LATERAL RESTRAINT -2
AFT RESTRAINT -2

B

NOTE

WHEN USING THREE OR MORE DEVICES FOR FORWARD RESTRAINT, EXTEND SOME TIE-DOWN DEVICES AFT TO THE NEXT ADDITIONAL FLOOR TIE-DOWN DEVICE TO AVOID THE CARGO SHIFTING OR TILTING FORWARD.

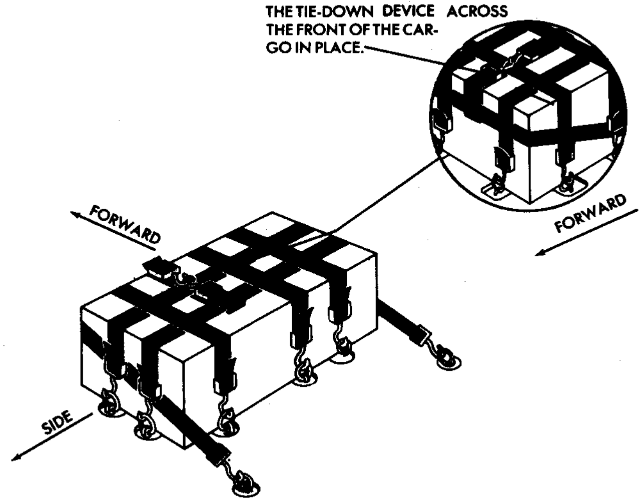
500 TO 750 POUNDS



TIE-DOWN DEVICES REQUIRED
FORWARD RESTRAINT -3
SIDE OR LATERAL RESTRAINT -2
AFT RESTRAINT -2

C

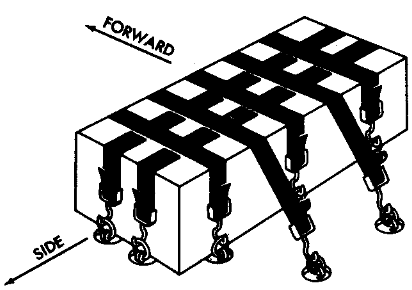
750 TO 1000 POUNDS



TIE-DOWN DEVICES REQUIRED
FORWARD RESTRAINT -4
SIDE OR LATERAL RESTRAINT -2
AFT RESTRAINT -3

D

1000 TO 1250 POUNDS



TIE-DOWN DEVICES REQUIRED
FORWARD RESTRAINT -5
SIDE OR LATERAL RESTRAINT -2
AFT RESTRANT -3

E

NOTE

1. THE TIE-DOWN DEVICES USED FOR FORWARD RESTRAINT WILL USUALLY SUPPLY MORE THAN ENOUGH AFT RESTRAINT
2. THE TIE-DOWN DEVICES USED FOR FORWARD AND AFT RESTRAINT WILL SUPPLY SUFFICIENT RESTRAINT FOR VERTICAL RESTRAINT.

Figure 5-6. Rules for Applying A-1A Tie-Down Device on Cargo of Various Weights Without Tie-Down Provisions

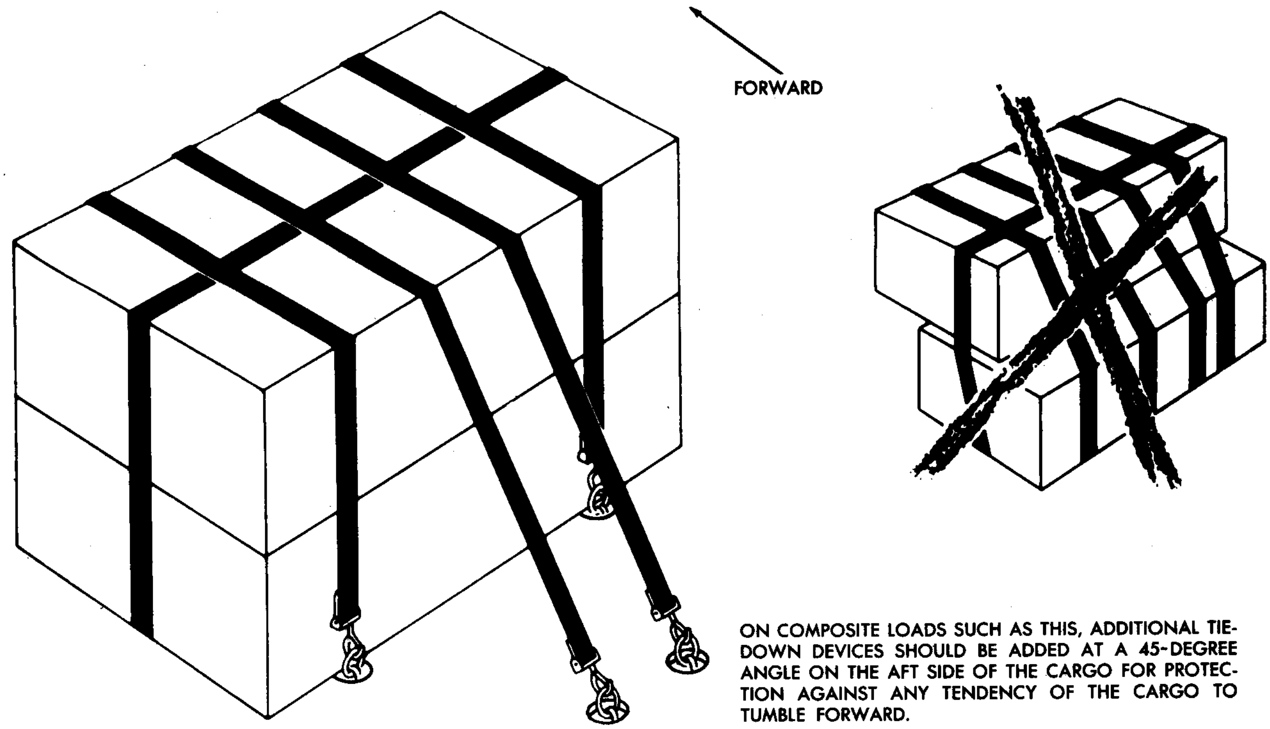


Figure 5-7. Composite Load Secured to Provide Sufficient Restraint and to Avoid Tumbling

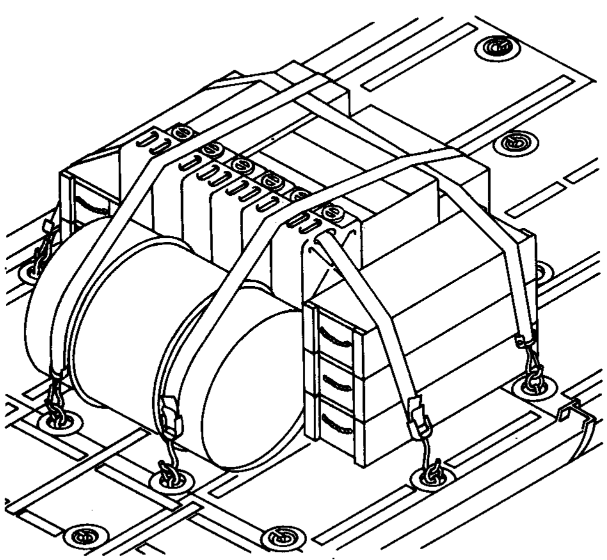


Figure 5-8. Typical Composite Cargo Load Without Tie-Down Provisions

this cargo in the forward and aft directions. (Refer to paragraph 5-17.)

500 x 4.0 G's = 2000 pounds of forward restraint
500 x 1.5 G's = 750 pounds of lateral restraint

b. Step 2. Determine the number of tie-down devices necessary to provide the required restraint.

FORWARD

$$\frac{\text{Required restraint}}{\text{Strength of tie-down}} = \frac{2000}{1250} = 1.6$$

Use 2 tie-down devices

LATERAL

$$\frac{\text{Required restraint}}{\text{Strength of tie-down}} = \frac{750}{1250} = 0.6$$

Use 2 tie-down devices

c. Step 3. Apply the tie-down devices to the load.

d. Step 4. In accordance with step 2, paragraph 5-30, check the load to see if any additional tie-down devices are required to prevent the load from shifting. In this case, because of the stacking method used, two tie-down devices will prevent the cargo from shifting laterally.

5-34. RESTRAINING CARGO WITH TIE-DOWN PROVISIONS. Special shipping containers, some items of equipment, and general cargo are provided with rings or other suitable points to which cargo tie-down devices can be attached. This type of

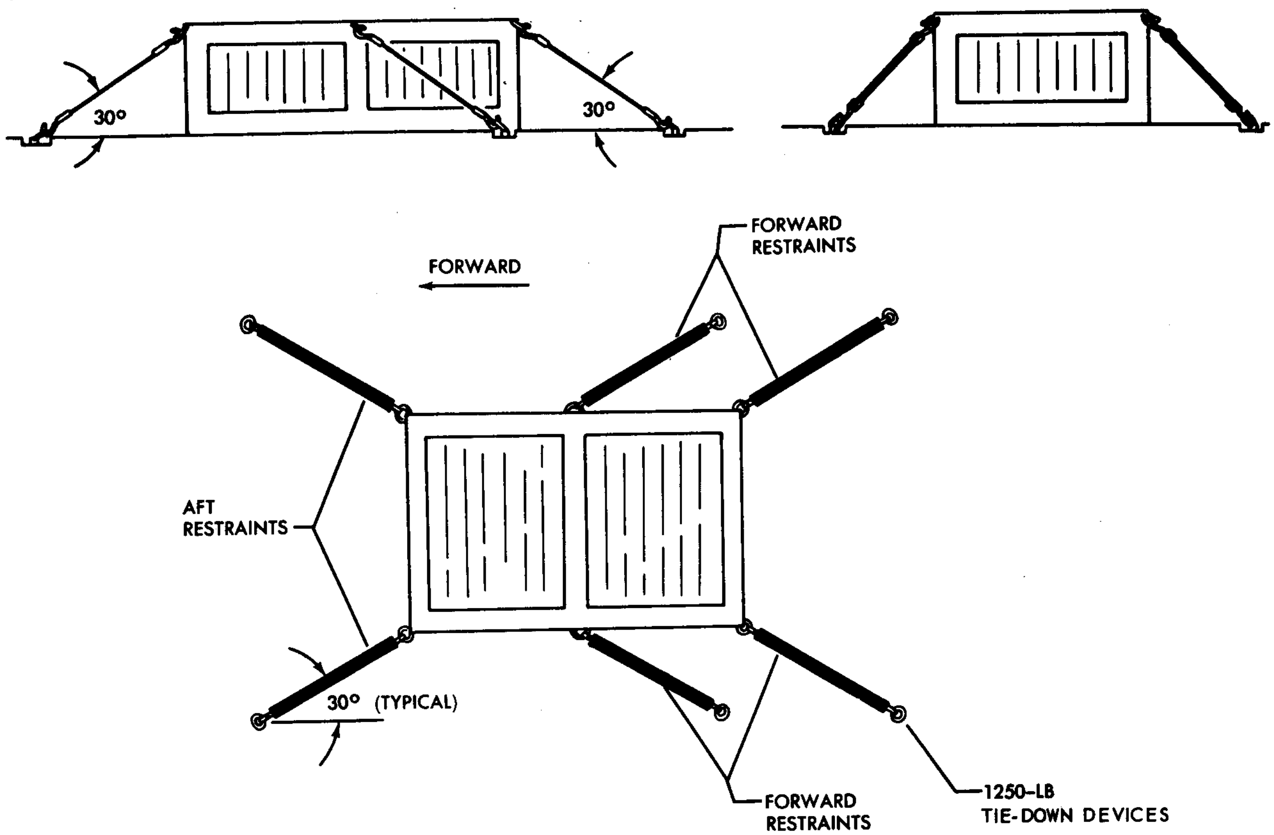
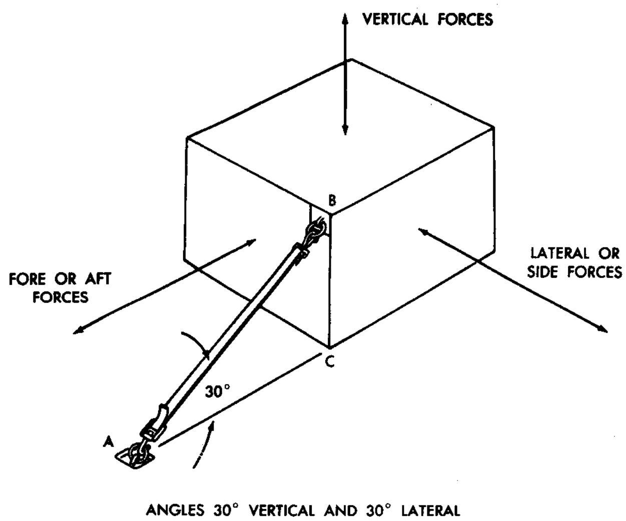


Figure 5-9. Typical Application of Tie-Down Devices to Cargo With Tie-Down Provisions

cargo should be secured as shown in figure 5-9. When cargo is secured by attaching tie-down devices directly to the cargo, there are two factors which must be kept in mind. (Refer to paragraphs 5-35 and 5-36.)

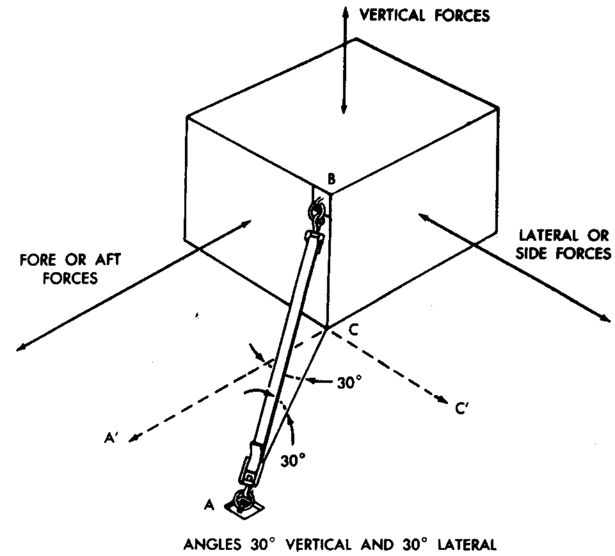
5-35. AMOUNT OF RESTRAINT. A tie-down device, attached between a tie-down ring or point on an item of cargo and a tie-down fitting in the cargo floor, will provide restraint equal to the floor, will provide restraint equal to the strength of the tie-down device in the direction of the tie-down device. In practice, however, it is not feasible to attach tie-down devices purely in the direction in which restraint is required because of the location of the tie-down provisions on the cargo. Most tie-down devices, out of necessity, must be attached at an angle to the desired direction of restraint and consequently only a part of the effective strength of the tie-down device will be available to provide restraint in the desired direction.

5-36. TIE-DOWN ANGLE. The tie-down angle is very important and must be considered since it determines the amount of restraint which can be obtained in any direction. To minimize the number of tie-down devices and to simplify the calculation of the number of tie-down devices required to restrain a load, all tie-down devices should be applied as closely as possible to the two rule of thumb tie-down angles shown in figure 5-10. Figure 5-10 shows the amount of restraint that can be obtained in any direction when the tie-down device is applied at the recommended tie-down angles. In tying down cargo, at least four tie-down devices should be applied at an angle of 30 degrees to the cargo floor and 30 degrees to the longitudinal axis of the helicopter, as shown in figure 5-11, in order to provide restraint in all directions. If additional restraint is needed in the forward direction, additional tie-down devices can be applied at the same tie-down angles or at an angle which is 30 degrees to the cargo floor and 0 degrees to the longitudinal axis of the helicopter. Tie-down devices applied to 30 degrees or 0 degrees concentrate more restraint in the forward direction than a tie-down device applied at a 30-degree tie-down angle, and it is for this reason that this tie-down angle is used. The amount of restraint that can be obtained at other than the rule of thumb tie-down angles is shown in table 5-II. The use of this table is explained in figure 5-12.



RESTRAINT AT RULE OF THUMB TIE-DOWN ANGLES
ONE A-1A 1250-POUND RATED TIE-DOWN DEVICE ATTACHED TO ONE 1250-POUND TIE-DOWN RING:

FORWARD OR AFT	1085 POUNDS
VERTICAL	625 POUNDS
LATERAL OR SIDE	0 POUNDS



RESTRAINT AT RULE OF THUMB TIE-DOWN ANGLES
ONE A-1A 1250-POUND RATED TIE-DOWN DEVICE ATTACHED TO ONE 1250-POUND TIE-DOWN-RING:

FORWARD OR AFT	940 POUNDS
VERTICAL	625 POUNDS
LATERAL OR SIDE	540 POUNDS

Figure 5–10. Rule of Thumb Tie-Down Angles

5–37. RULES FOR APPLYING TIE-DOWNS TO CARGO WITH TIE-DOWN PROVISIONS.

a. Rule 1. Always apply an even number of tie-downs attached in pairs for forward and aft restraint.

b. Rule 2. Apply tie-downs as close as possible to the rule of thumb tie-down angles. Apply the first four tie-down devices so that the tie-down angle is 30 degrees with the cargo floor and 30 degrees with the longitudinal axis of the helicopter.

c. Rule 3. If tie-down device can be applied at the rule of thumb tie-down angles, see figure 5–11 to determine the number of tie-down devices required to provide restraint.

d. Rule 4. If tie-down devices cannot be applied at the rule of thumb tie-down angles, follow the procedure outlined in the sample problem. (See figure 5–12.)

5–38. A–1A TIE-DOWN DEVICE.

5–39. The A–1A tie-down device has a rated and ultimate capacity of 1250 pounds and consists of a 15-foot webbed strap on which there are two hook assemblies, one stationary and one adjustable. In use, the stationary hook assembly of the tie-down device is attached to a tie-down fitting provided on the item of cargo being secured and the adjustable hook assembly of the tie-down device is adjusted and attached to the cargo floor tie-down fitting. When using the tie-down device on the cargo without tie-down provision, the stationary hook assembly is attached first to the cargo floor; the device is then passed over the cargo and the adjustable hook assembly is adjusted and attached to the cargo floor tie-down fitting. In either case, the tie-down device is tightened by pulling its free end through the adjustable hook assembly which will automatically lock in place. To remove the device, tension on the strap is released by pressing a thumb plate between the sides of the adjustable hook. Eighteen of the devices are carried in the helicopter and, when not in use, are stowed in shelves on the lower section of the cargo compartment wall below the troop seats. (See figure 3–4.)

THIS CHART PROVIDES A SIMPLE METHOD FOR DETERMINING THE MINIMUM NUMBER OF TIE-DOWN DEVICES REQUIRED TO MEET THE RESTRAINT CRITERIA FOR DIFFERENT CARGO WEIGHTS

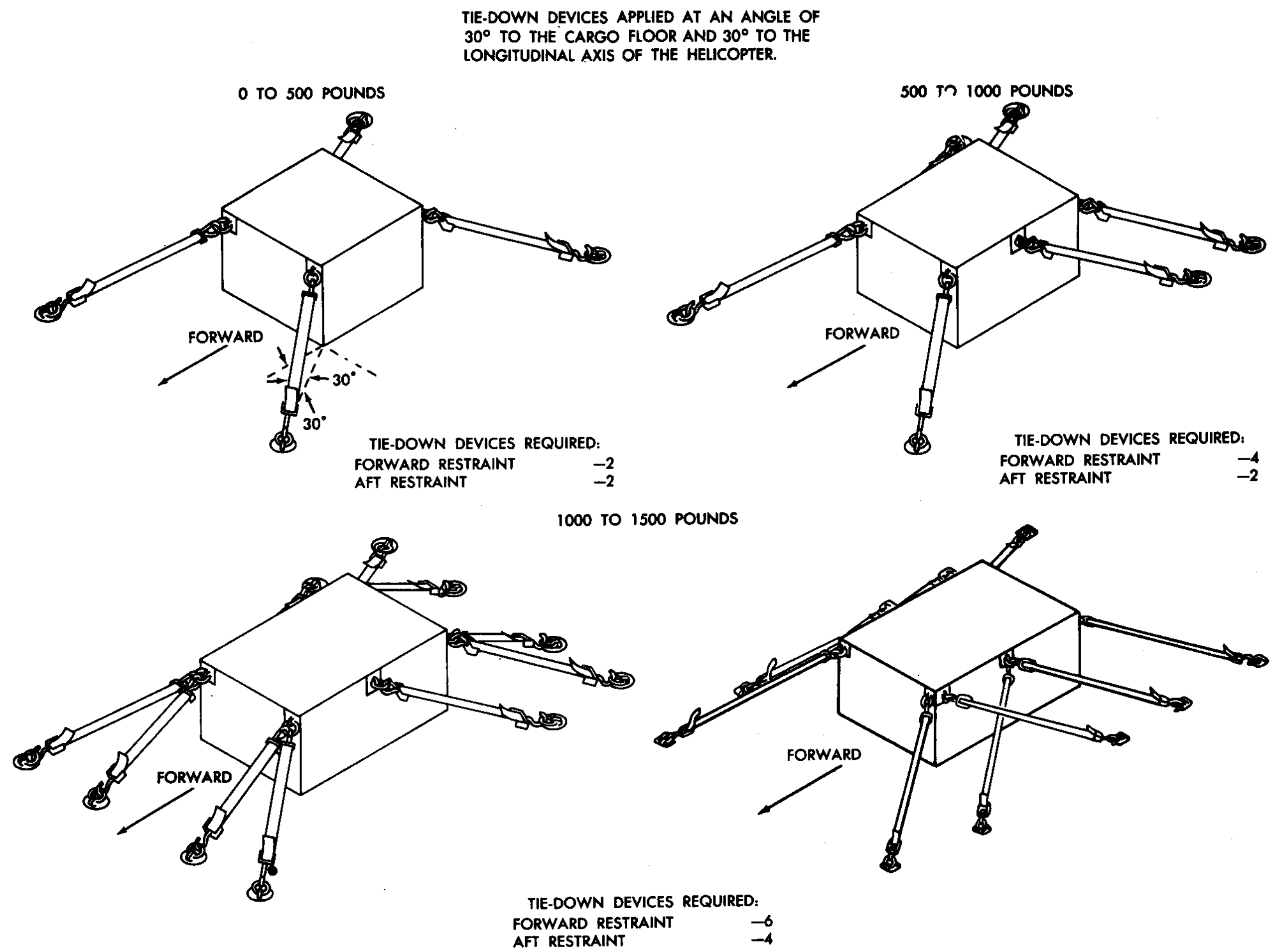
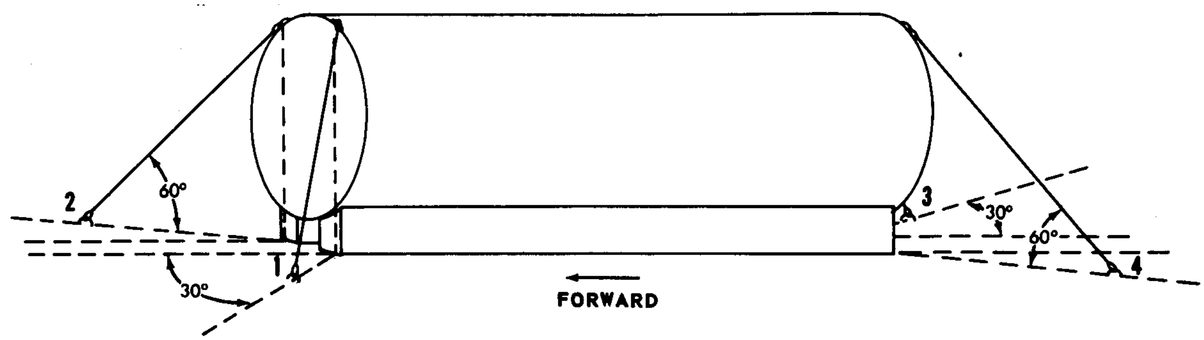


Figure 5–11. Rule of Thumb for Determining Number of Tie-Down Devices on Cargo of Various Weights With Tie-Down Provisions



KNOWN: The shipping container shown weighs 250 pounds and because of its shape, size, and the tie-down fitting locations, the tie-down devices cannot be applied at an angle of 30 degrees to the cargo floor.

PROBLEM: How many tie-down devices are required to properly secure the container?

Step 1. Determine the amount of restraint required in each direction.

250 x 4g's=1000 pounds of forward restraint
250 x 1.5g'=375 pounds at lateral restraint
250 x 2g's=500 pounds of aft restraint
250 x 2g's=500 pounds of vertical restraint

Step 2. Check figure 5–11 and determine how many tie-down devices would be required if the container could be secured at the rule of thumb tie-down angles. Figure 5–11 shows that at least four tie-down devices are required

Step 3. Tie down the container with the number of the tie-down devices determined in Step 2. Apply the tie-down devices as close as possible to the rule of thumb tie-down angle.

Step 4. Construct a table similar to the one shown here and estimate the tie-down angle for each tie-down device.

Step 5. Obtain from table II the amount of restraint that is actually provided by each tie-down device and add the results to determine how much restraint is actually provided in each direction.

Step 6. Compare the actual restraint found in Step 5 with the restraint required found in Step 1. If the actual restraint is less add additional tie-down devices and continue the procedure until sufficient restraint is obtained. In this case, no additional tie-down devices are required since the actual restraint is greater than the required restraint.

TIE-DOWN	STRENGTH OF FLOOR FITTINGS	ESTIMATED ANGLES		RESTRAINT				
		VERTICAL	LATERAL OR SIDE	FORWARD	VERTICAL	LATERAL		AFT
						RIGHT	LEFT	
1.	1250	60	30	0	1085	315	0	540
2.	1250	60	30	0	1085	0	315	540
3.	1250	60	30	540	1085	0	315	0
4.	1250	60	30	540	1085	315	0	0
TOTAL RESTRAINT				1080	4340	630	630	1080

Figure 5–12. Tie-Down at Other Than Rule of Thumb Tie-Down Angles

SECTION VI

LOADING AND UNLOADING OF OTHER THAN GENERAL CARGO

Information to be furnished.

CHAPTER 14
PERFORMANCE DATA
SECTION I
SCOPE

1–1. GENERAL.

1–2. The tables and charts presented in this chapter contain the performance data necessary for accurate and complete flight planning.

1–3. Table 1–I lists the symbols used in the charts and explanatory notes and gives a definition of each symbol.

TABLE 1-I
SYMBOLS AND DEFINITIONS

SYMBOL	DEFINITION	SYMBOL	DEFINITION
AC	ALTERNATING CURRENT	LB/GAL	POUNDS PER GALLON
AC	AIRSPEED CORRECTION		
ACCEL DIST	ACCELERATING DISTANCE	LB/HR	POUNDS PER HOUR
ALT	ALTITUDE	MANF PRESS.	MANIFOLD PRESSURE
BHP	BRAKE HORSEPOWER	METO	MAXIMUM EXCEPT TAKEOFF
°C	DEGREES CENTIGRADE	MIN	MINUTES
CAS	CALIBRATED AIRSPEED	MPH	MILES PER HOUR
CG	CENTER OF GRAVITY	N	NORMAL
DC	DIRECT CURRENT	OAT.	OUTSIDE AIR TEMPERATUPE
°F	DEGREES FAHRENHEIT	PRESS.	PRESSURE
FT	FEET	PSI	POUNDS PER SQUARE INCH
FPM	FEET PER MINUTE	ROC	RATE OF CLIMB
GAL	GALLONS	ROD.	RATE OF DESCENT
IAS	INDICATED AIRSPEED	RPM	REVOLUTIONS PER MINUTE
IN.	INCHES	SL	SEA LEVEL
IN. HG	INCHES OF MERCURY (MANIFOLD PRESSURE)	STD	STANDARD
		TAS	TRUE AIRSPEED
KN	KNOTS	TEMP	TEMPERATURE
LB	POUNDS		

SECTION II

CHARTS

2-1. ENGINE VS ROTOR RPM.
(Refer to table 2-I.)

2-2. The engine vs actual rotor rpm table may be used to determine rotor speeds for various engine rpm.

2-3. AIRSPEED INSTALLATION CORRECTION.
(Refer to table 2-II.)

2-4. The airspeed installation correction table shows the calibrated airspeeds for various indicated airspeeds attained during forward climb, level flight, and autorotation.

2-5. DENSITY ALTITUDE. (See chart 2-I.)

2-6. The density altitude chart shows the density altitude for standard and nonstandard atmospheric conditions. Density altitude is an expression of the air in terms of height above sea level; hence, the less dense the air the higher the density altitude.

TABLE 2-I
ENGINE RPM VS ACTUAL ROTOR RPM
11.293 to 1

ENGINE RPM	ACTUAL ROTOR RPM	ENGINE RPM	ACTUAL ROTOR RPM
1000	89	2000	177
1100	97	2100	186
1200	106	2200	195
1300	115	2300	203
1400	124	2400	212
1500	133	2500	221
1600	142	2600	230
1700	150	2700	239
1800	159	2800**	248
1900	168	2900	256
		2914*	258*

*ROTOR RED LINE
**ENGINE RED LINE

TABLE 2-II
AIRSPEED INSTALLATION CORRECTION

IAS	LEVEL FLIGHT		CLIMB		AUTO	
	AC	CAS	AC	CAS	AC	CAS
0	0	0				
20	+8	28	−8	12	+9	29
40	+7	47	−8	32	+4	44
60	+3	63	−9	51	+3	63
80	+1	81	−9	71	+3	83
100	+1	101				
120	+1	121				

For standard conditions of temperature and pressure, density altitude is the same as pressure altitude. As temperature increases above standard for any altitude, the density altitude will also increase to values higher than pressure altitude. Helicopter pilots are vitally concerned with density altitude and its relation to the performance of the helicopter. A high density altitude affects the performance of both the main rotor and the engine in a decidely adverse manner. When density altitude is high, less lift is developed by the rotor blades for any given power settings than at standard conditions. When density altitude is high, a given volume of air provides less oxygen for combustion in the cylinders, decreasing the volumetric efficiency and reducing the power output of the engine below the output for standard conditions. When low temperatures prevail, relative humidity has little effect on helicopter performance. When both temperature and relative humidity are high, the volumetric efficiency of the engine is reduced even more due to the water vapor displacing an equal amount of air in any given volume. As density altitude increases, useful load must be decreased. Each takeoff and landing must be separately evaluated as density altitude may change considerably in a short period of time. Chart 2-I expresses density altitude in terms of pressure altitude and temperature. An example of the use of the standard atmospheric chart is contained on the chart. The value of $1/\sqrt{\sigma}$ is a conversion factor used to obtain true airspeed

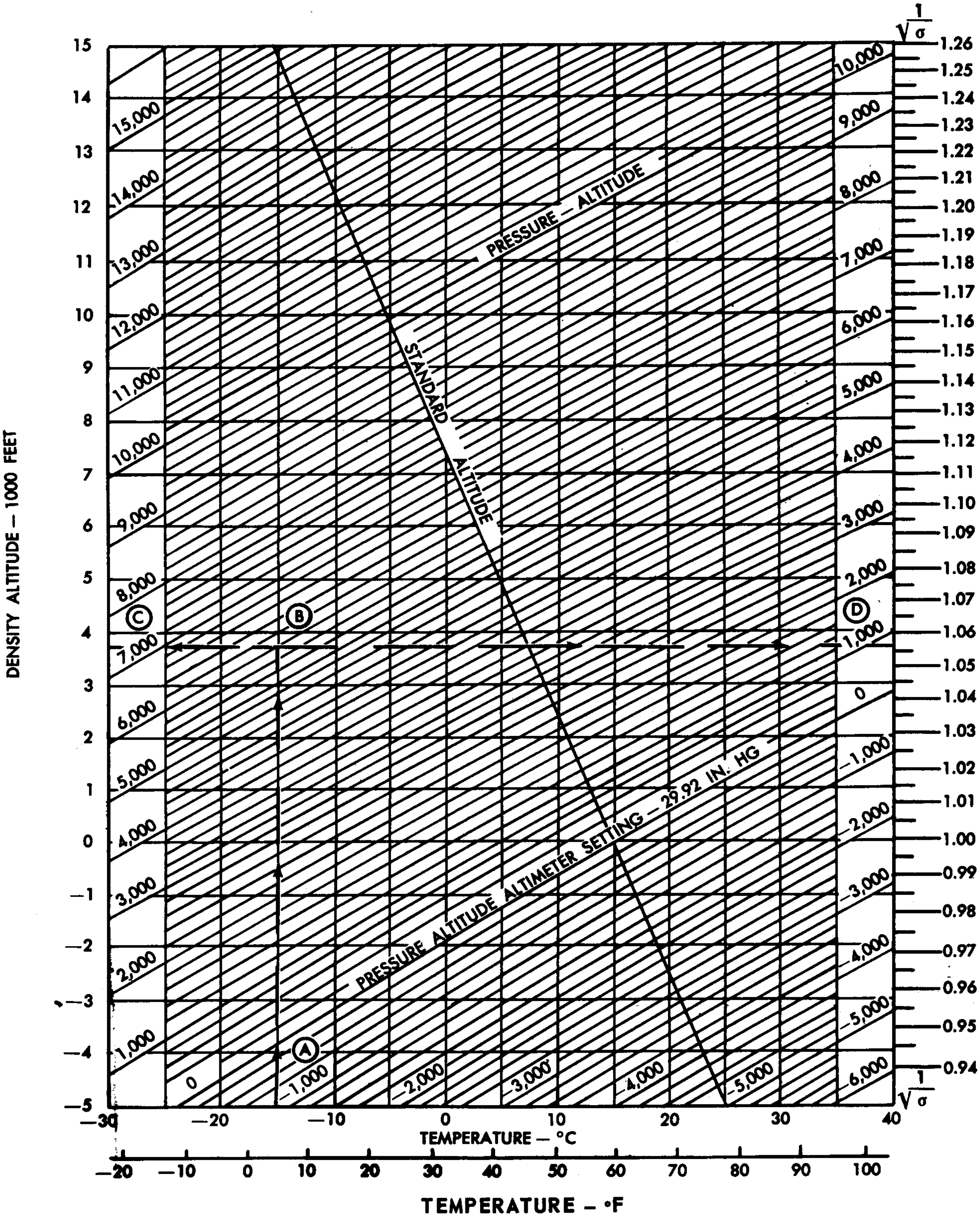


Chart 2–1. Density Altitude

from calibrated airspeed by correcting for density altitude. Multiply the calibrated airspeed by $1/\sqrt{\sigma}$ to obtain true airspeed. For example, if the CAS were 100 knots and $1/\sqrt{\sigma}$ were 1.06, the true airspeed would be 106 knots.

2–7. USE OF THE CHART.

2–8. EXAMPLE 1. Determine the density altitude and conversion factor when the ambient temperature is -15°C (5°F) and the pressure altitude is 6000 feet.

a. Enter chart at -15°C (5°F) (point A).

b. From point A, move vertically to the intersection of pressure altitude of 6000 feet (point B).

c. Move horizontally to left to point C. Density altitude is 3800 feet.

d. Move horizontally to right to point D. Conversion factor is 1.058.

2–9. POWER CHECK. (See chart 2–II.)

2–10. The power check chart indicates the manifold pressure required for the helicopter to hover with various combinations of pressure altitude, gross weight, temperature, dew point, and headwind.

2–11. USE OF THE CHART.

2–12. EXAMPLE 1. Determine the manifold pressure to hover with a 5-foot wheel clearance at sea level with a gross weight of 11,500 pounds, a 20-knot headwind, an OAT. of 25°C (77°F) and a dew point of 18°C (64°F).

a. Enter chart at 11,500 pounds (point A).

b. From point A, move parallel to headwind influence curve to 20 knots (point B).

c. From point B, move vertically to -18°C (0°F) dew point (point C).

d. From point C, move parallel to dew point influence curve to a dew point of 18°C (64°F) (point D).

e. From point D, move vertically to an altitude of sea level (point E).

f. From point E, move parallel to temperature influence slope to an OAT. of 25°C (77°F) (point F).

g. From point F, move vertically to the manifold pressure curve at sea level (point G).

h. From point G, move horizontally to manifold pressure 36.0 inches Hg (point H).

2–13. For the above conditions it would require a manifold pressure of 36.0 inches Hg to hover at 5 feet above the ground at sea level with a gross weight of 11,500 pounds.

2–14. MAXIMUM ALLOWABLE MANIFOLD PRESSURE AT VARIOUS RPM AND ALTITUDE – AS INSTALLED. (Refer to table 2–III.)

2–15. The maximum allowable manifold pressure shows that as altitude is increased up to the critical altitude, manifold pressures must be reduced in accordance with this table to avoid exceeding the power limitations. Above the critical altitude, power drops off even though full throttle is used.

2–16. TAKEOFF DISTANCES. (Refer to table 2–IV.)

2–17. The takeoff distances table includes the minimum total distance to clear a 50-foot object with various gross weight, temperature, and altitude conditions. Three types of takeoffs are shown on the chart: vertical takeoffs with vertical climb, vertical takeoffs with an air acceleration in level flight followed by a climb, and rolling takeoffs followed by a climb.

2–18. Vertical takeoffs and climbs can be accomplished when gross weight, altitude, and temperature permit. However, for normal takeoffs as described in Chapter 3, forward speed should be obtained after takeoff to avoid the shaded area of chart 2–I, Chapter 7. Vertical takeoffs and vertical climbs are indicated on the table by zeros in the columns headed IAS KN, ACCEL RUN, and CLEAR 50 FT.

2–19. Vertical takeoffs with air accelerations in level flight with the wheels clear of the ground are necessary when gross weight, altitude, and temperature conditions permit hovering in ground effect but not out of ground effect and when rolling takeoffs cannot be accomplished due to ground obstructions. In order to climb under these conditions, it is necessary to gain the additional lift developed in forward flight before attempting to climb. The values in the column headed IAS KN are the airspeeds required to produce sufficient lift for climbing. Climbs should not be attempted until these airspeeds are obtained. Air accelerations and total distance to clear a 50-foot object are the unmarked values in the table.

2–20. Rolling takeoffs are necessary when gross weight, temperature, and altitude conditions prevent hovering in ground effect. The ground run necessary to produce sufficient airspeed and total distance to clear a 50-foot object are the values marked with an asterisk (*) in the table. The values in the column headed IAS KN opposite a value marked with an asterisk (*) and the airspeeds required to produce sufficient lift for the helicopter to become

HOVERING WITH 5 FEET WHEEL CLEARANCE
2500 RPM

MODEL: CH-34A
DATE: APRIL 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1820-84A
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

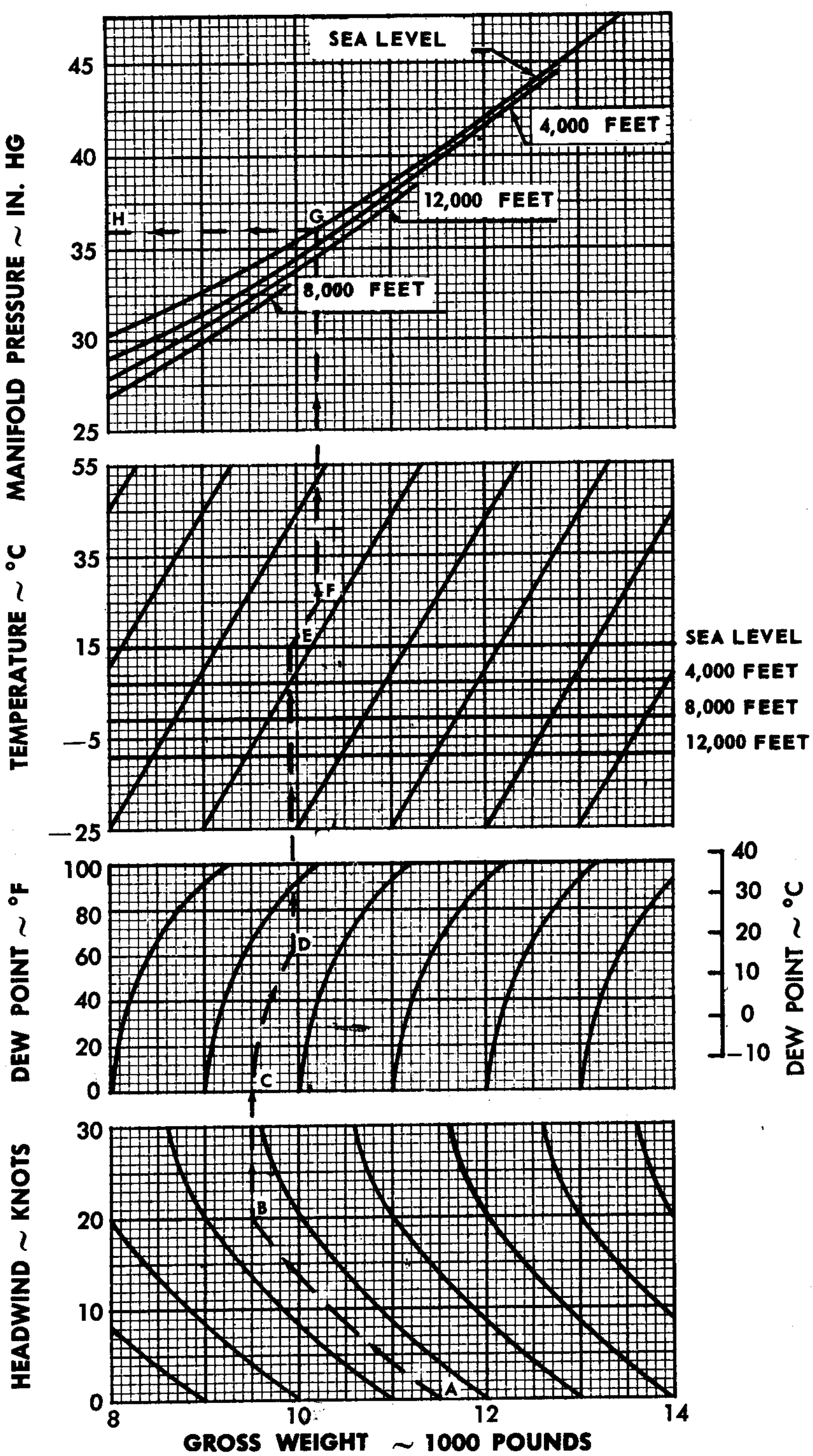


Chart 2-11. Power Check

TABLE 2-III

MAXIMUM ALLOWABLE MANIFOLD PRESSURE AT VARIOUS RPM AND ALTITUDE – AS INSTALLED

MODELS: CH-34A & CH-34C
DATE: APRIL 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1820-84A
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

RPM	ALTITUDE						TIME
	S.L.	2000	4000	6000	8000	10000	
2800	56.5	F.T.	F.T.	F.T.	F.T.	F.T.	5 MINUTES
2700	52.0	51.2	F.T.	F.T.	F.T.	F.T.	30 MINUTES
2500	47.5	46.6	F.T.	F.T.	F.T.	F.T.	CONTINUOUS
2400	42.5	41.9	41.3	F.T.	F.T.	F.T.	
2300	38.6	38.0	37.4	36.8	F.T.	F.T.	
2200	35.5	34.9	34.3	33.7	33.2	F.T.	

ALTERNATE GRADE FUEL (100/130)

RPM	ALTITUDE						TIME
	S.L.	2000	4000	6000	8000	10000	
2800	53.0	52.1	F.T.	F.T.	F.T.	F.T.	5 MINUTES
2700	51.0	50.4	F.T.	F.T.	F.T.	F.T.	30 MINUTES
2500	47.5	46.6	F.T.	F.T.	F.T.	F.T.	CONTINUOUS

NOTE: BELOW 2500 RPM ALLOWABLE MANIFOLD PRESSURES ARE NOT AFFECTED BY USE OF 100/130 GRADE FUEL
F.T. = FULL THROTTLE

airborne. Rolling takeoffs should only be accomplished from smooth, unobstructed surfaces.

2-21. TAKEOFF GROSS WEIGHT LIMITATIONS. (See chart 2–III.)

2–22. This chart shows the takeoff gross weight, as limited by vertical rate of climb out of ground effect at maximum power, for various combinations of altitude, temperature, and dew point.

2–23. USE OF THE CHART.

2–24. EXAMPLE 1. Determine the takeoff gross weight at a pressure altitude of 4000 feet with 25°C (77°F) OAT. and a 14°C (57°F) dew point requiring a 100 feet per minute vertical climb out of ground effect using maximum power.

a. Enter chart at 4000 feet (point A).

b. From point A, move horizontally to an OAT. of 25°C (77°F) (point B).

c. From point B, move downward to a dew point of -18°C (0°F) (point C).

d. From point C, move parallel to dew point influence lines to 14°C (57°F) (point D).

e. From point D, move downward to 0 vertical climb (point E).

TABLE 2-IV
TAKEOFF DISTANCES

MODELS: CH-34A & CH-34C
DATE: JUNE 1959
DATA BASIS: FLIGHT TEST

FIRM DRY SOD
CONFIGURATION: CLEAN

ENGINE: R-1820-84A
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

GROSS WEIGHT LB	PRESSURE ALTITUDE 1000 FEET	-25°C			-5°C			+15°C			+35°C			+55°C		
		IAS KN	ACCEL RUN	CLEAR 50 FT	IAS KN	ACCEL RUN	CLEAR 50 FT	IAS KN	ACCEL RUN	CLEAR 50 FT	IAS KN	ACCEL RUN	CLEAR 50 FT	IAS KN	ACCEL RUN	CLEAR 50 FT
13,500	SL	0	0	0	0	0	0	0	0	0	26	120	615	31	375	915
	2	0	0	0	0	0	0	28	160	700	33	400	1080	38	253*	1080*
	4	0	0	0	30	200	770	36	185*	890*	37	295*	1230*	42	460*	1720*
	6	31	235	835	37	205*	980*	40	345*	1395*	44	545*	2040*	—	—	—
	8	38	235*	1060*	41	385*	1570*									
	10	42	415*	1740*												
	12															
12,000	SL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	24	125	675
	4	0	0	0	0	0	0	0	0	0	27	195	795	31	180*	385*
	6	0	0	0	22	90	590	30	310	925	35	220*	1020*	38	345*	1375*
	8	24	115	660	31	380	850	36	270*	1150*	40	435*	1625*	—	—	—
	10	34	180*	895*	38	315*	1311*	41	520*	1900*	—	—	—	—	—	—
	12	38	345*	1415*	42	610*	2195*									
10,500	SL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6	0	0	0	0	0	0	0	0	0	0	0	0	24	175	790
	8	0	0	0	0	0	0	21	95	630	27	265	965	33	225*	1045*
	10	0	0	0	24	140	735	31	165*	890*	35	290*	1225*	38	465*	1690*
	12	26	205	840	33	205*	1005*	36	350*	1440*	39	575*	2070*	—	—	—
9,000	SL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10	0	0	0	0	0	0	0	0	0	18	70	570	23	200	830
	12	0	0	0	0	0	0	20	125	690	26	289	1085	32	255*	1155*

NOTE:
1. POWER SETTINGS 56.5 IN. HG MANIFOLD PRESSURE AND 2800 RPM AT SEA LEVEL (1525 BHP).
2. ACCELERATING RUNS UNMARKED ARE FOR VERTICAL TAKEOFF AND AIR ACCELERATION.
3. ACCELERATING RUNS MARKED WITH AN * ARE FOR GROUND RUNS ON PREPARED RUNWAYS.
4. FOR EACH 10 KNOTS OF HEADWIND DECREASE ACCELERATION DISTANCE 120 FEET AND TOTAL TAKEOFF DISTANCE BY 280 FEET.

MAXIMUM POWER ZERO WIND
OUT OF GROUND EFFECT

MODEL: CH-34A
DATE: APRIL 1959
DATA BASIS: FLIGHT TEST

ENGINE: R-1820-84A
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

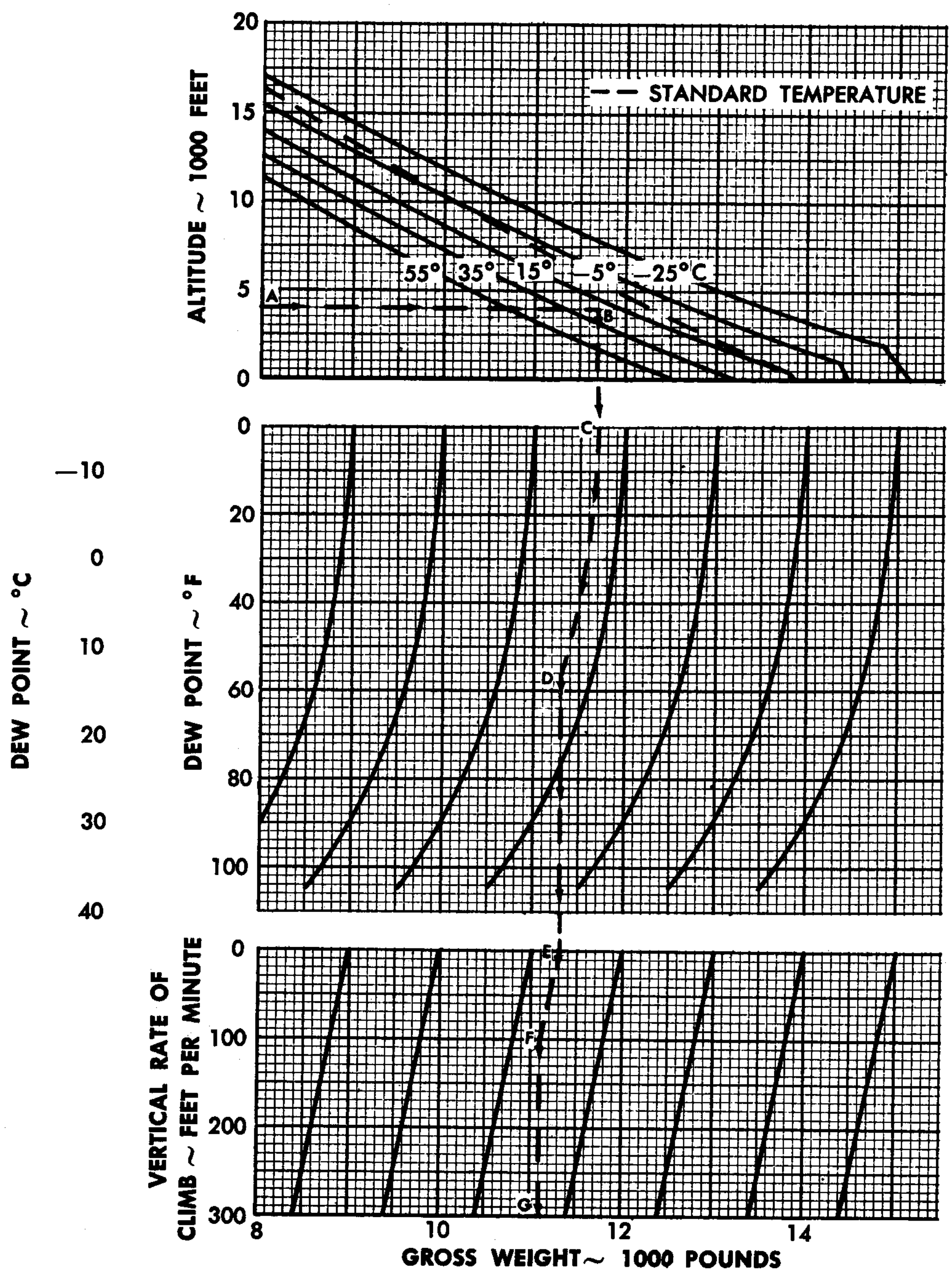


Chart 2–III. Takeoff Gross Weight Limitations

MAXIMUM GROSS WEIGHT FOR HOVERING OUT OF GROUND EFFECT 2700 RPM

MODEL: CH-34A
DATE: APRIL 1959
DATA: FLIGHT TEST

ENGINE: R-1820-84A
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

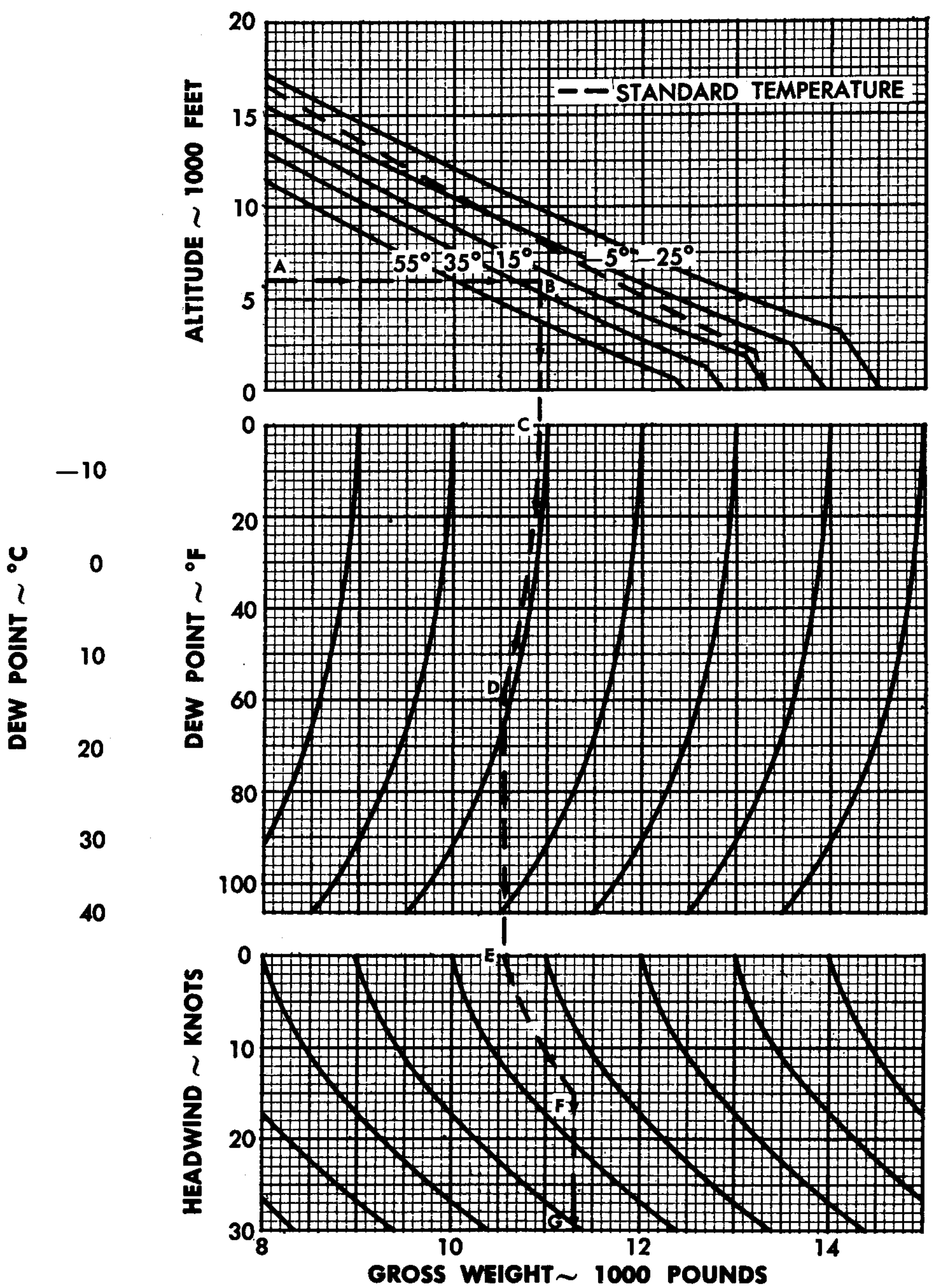


Chart 2–IV. Hovering

f. From point E, move parallel to vertical climb influence lines to 100 feet per minute climb (point F).

g. From point F, move vertically to base line to obtain gross weight (point G). For above conditions, takeoff gross weight would be 11,100 pounds.

2–25. MAXIMUM GROSS WEIGHT FOR HOVERING OUT OF GROUND EFFECT. (See chart 2–IV.)

2–26. The maximum gross weight at which the helicopter can be hovered out of ground effect at various combinations of altitudes, dew point, and headwinds may be determined from this chart.

2–27. USE OF THE CHART.

2–28. EXAMPLE 1. Determine the maximum hovering weight out of ground effect using military power at 6000 feet with 25°C (77°F) OAT., 14°C (57°F) dew point, and 15-knot headwind.

a. Enter chart at 6000 feet (point A).

b. From point A, move horizontally to an OAT. of 25°C (77°F) (point B).

c. From point B, move downward to a dew point of -18°C (0°F) (point C).

d. From point C, move parallel to dew point influence curve to a dew point of 14°C (57°F) (point D).

e. From point D, proceed downward to 0 headwind (point E).

f. From point E, move parallel to headwind influence curve to 15 knots (point F).

g. From point F, move vertically to gross weight (point G). For above conditions, maximum hovering gross weight out of ground effect with military power would be 11,300 pounds.

2–29. CLIMB TABLE FOR METO POWER. (Refer to table 2–V.)

2–30. This table indicates the maximum rate of climb at best rate-of-climb speed at various temperatures with various weight and altitude combinations. Also shown is the time to climb from sea level to any altitude, the fuel used, and the distance in nautical miles. The fuel used includes a warmup and takeoff allowance of 82 pounds which is equivalent to the fuel consumption at METO power, 1275 BHP, for 5 minutes. Climbs are based on 47.5 inches Hg with 2500 engine rpm at sea level and 45.5 inches Hg (full throttle) with 2500 engine rpm at 3700 feet.

2–31. RANGE TABLE. (Refer to table 2–VI.)

2–32. The range table is divided into three sheets, each showing one cruise condition. Each table shows the range, fuel consumption, power settings, and airspeeds at various combinations of gross weight and altitude. Sheet 1 is for cruise conditions at best range power settings, sheet 2 is for cruise conditions using an intermediate power setting, and sheet 3 is for cruise conditions at METO power. It will be noted from the tables that as range increases, both airspeed and power settings decrease.

2–33. MAXIMUM ENDURANCE. (Refer to table 2–VII.)

2–34. This table shows the power settings that will produce maximum endurance at various weight and altitude combinations. Fuel consumption, airspeeds, and endurance for various quantities of fuel are shown for each gross weight – altitude combination.

2–35. HOVERING ENDURANCE. (Refer to table 2–VIII.)

2–36. This table shows the power settings that will produce hovering endurance at various gross weight and altitude combinations using minimum hovering rpm. Fuel consumption, minimum airspeeds, and endurance for various quantities of fuel are shown for each gross weight – altitude combination.

2–37. LANDING DISTANCE – FEET. (Refer to table 2–IX.)

2–38. The landing distance table includes the best power-off approach speed, ground roll, and distance to clear a 50-foot obstruction at various combinations of altitude, temperature, and gross weight. Power-on landing distances will be approximately 10 to 15 percent less than power-off landing distances. With gross weight, temperature, and altitude conditions where hovering out of ground effect is possible, vertical descent with power can be made. For these conditions, see chart 2-IV.

2–39. TAKEOFF AND LANDING DATA CARD. (See figure 2–1.)

2–40. The takeoff and landing data card shown in figure 2–1 is also included in TM 55-1520-202-10CL. The data card provides readily available information for takeoff and landing. Information required to fill out the data card can be obtained from charts and tables contained in this chapter.

TABLE 2-V

CLIMB TABLE FOR METO POWER

CONFIGURATION: CLEAN

MODELS: CH-34A & CH-34C
DATE: DECEMBER 1957
DATA BASIS: FLIGHT TEST

ENGINE: R-1820-84A
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

		GROSS WEIGHT (POUNDS)															
		13,500				12,000				10,500				9,000			
				FROM SL				FROM SL				FROM SL				FROM SL	
TEMPERATURE DEGREE CENTIGRADE (FAHRENHEIT)	PRESSURE ALTITUDE	BEST CAS KNOTS	RATE OF CLIMB FPM	TIME MIN	FUEL USED LB	BEST CAS KNOTS	RATE OF CLIMB FPM	TIME MIN	FUEL USED LB	BEST CAS KNOTS	RATE OF CLIMB FPM	TIME MIN	FUEL USED LB	BEST CAS KNOTS	RATE OF CLIMB FPM	TIME MIN	FUEL USED LB
-25°C (-13°F)	SL	65	1270	0	82	65	1620	0	82	65	2050	0	82	65	2620	0	82
	2000	63	1240	2	110	63	1610	2	103	63	2040	1	99	63	2610	1	96
	4000	61	1210	4	138	61	1600	3	124	61	2030	2	116	61	2610	2	109
	6000	59	980	5	168	59	1370	4	147	59	1830	3	133	59	2270	3	122
	8000	57	660	8	203	57	1120	6	171	57	1460	4	151	57	2100	4	135
	10000	55	280	12	246	55	830	8	199	55	1300	6	171	55	1820	5	151
	12000					53	470	11	237	53	1040	8	191	53	1550	6	165
-5°C (23°F)	SL	65	1160	0	82	65	1420	0	82	65	1920	0	82	65	2480	0	82
	2000	63	1140	2	112	63	1500	2	104	63	1920	1	99	63	2460	1	96
	4000	61	1050	4	141	61	1420	3	127	61	1870	2	117	61	2420	2	110
	6000	59	780	6	174	59	1200	5	150	59	1630	3	133	59	2150	3	121
	8000	57	420	10	216	57	920	6	176	57	1360	5	152	57	1860	4	135
	10000					55	600	9	208	55	1020	6	173	55	1620	5	151
	12000					53	190	14	266	53	820	9	195	53	1350	6	166
+15°C (59°F)	SL	65	1030	0	82	65	1390	0	82	65	1810	0	82	65	2340	0	82
	2000	63	1020	2	114	63	1580	2	106	63	1810	1	100	63	2320	1	96
	4000	61	860	4	145	61	1250	3	129	61	1680	2	118	61	2220	2	110
	6000	59	520	7	188	59	1000	5	155	59	1440	4	136	59	1960	3	123
	8000	57	80	11	250	57	740	7	185	57	1200	5	158	57	1700	4	138
	10000					55	320	11	228	55	940	7	180	55	1440	5	151
	12000									53	620	10	207	53	1180	7	167
+35°C (95°F)	SL	65	940	0	82	65	1300	0	82	65	1710	0	82	65	2220	0	82
	2000	63	900	3	116	63	1270	2	107	63	1710	1	100	63	2210	1	96
	4000	61	660	5	154	61	1090	4	132	61	1510	3	119	61	2030	2	110
	6000	59	260	10	212	59	840	6	160	59	1270	4	138	59	1760	3	124
	8000					57	470	9	196	57	1030	6	160	57	1520	4	140
	10000					55	30	16	275	55	720	8	186	55	1260	6	154
	12000									53	340	12	219	53	1000	9	171
+55°C (131°F)	SL	65	860	0	82	65	1200	0	82	65	1600	0	82	65	2120	0	82
	2000	63	790	3	119	63	1060	2	108	63	1590	1	101	63	2120	1	97
	4000	61	400	6	167	61	920	4	135	61	1350	3	120	61	1860	2	110
	6000					59	600	7	167	59	1110	5	142	59	1600	3	126
	8000					57	200	11	224	57	830	7	167	57	1360	5	140
	10000									55	500	9	195	55	1000	6	156
	12000									53	40	15	239	53	830	9	178

NOTE: 1. 2500 RPM.
2. FUEL WARMUP AND TAKEOFF ALLOWANCE = 82 LB (5 MINUTES AT 1275 BHP).
3. CLIMBS BASED ON 47.5 IN. HG AND 2500 RPM AT SEA LEVEL (1275 BHP).

TABLE 2-VI
RANGE TABLE

STANDARD DAY — CRUISE CONDITION – BEST RANGE

MODELS: CH-34A & CH-34C
DATE: AUGUST 1958
DATA BASIS: FLIGHT TEST

ENGINE: R-1820-84A
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

GROSS WEIGHT	PRESS. ALT	POWER SETTINGS: ENGINE SPEED	MANF. PRESS.	MIX-TURE	APPROXIMATE TOTAL	SPEED/KNOTS		RANGE – NAUTICAL MILES: 1572 LB FUEL	1400 LB FUEL	1200 LB FUEL	1000 LB FUEL	800 LB FUEL	600 LB FUEL	400 LB FUEL	200 LB FUEL	LB FUEL
POUNDS	FEET	RPM	IN. HG.		LB/HR	TAS	CAS									
13,500	12000															
	10000															
	8000															
	6000															
	4000	2400	34.0	N	552	85	80	242	216	185	154	123	92	61	31	
	2000	2400	33.9	N	530	88	85	261	232	199	166	133	100	66	33	
	SL	2300	34.4	N	482	85	85	277	246	212	176	141	106	71	35	
12,000	12000															
	10000															
	8000	2500	30.0	N	488	89	79	287	255	219	182	146	109	73	36	
	6000	2400	30.1	N	450	88	80	307	274	235	196	156	117	78	39	
	4000	2300	30.1	N	396	82	77	326	290	249	207	166	124	83	41	
	2000	2200	30.5	N	380	80	77	331	295	253	211	168	126	84	42	
	SL	2200	31.4	N	380	84	84	348	310	265	221	177	133	88	44	
10,500	12000	2500	27.4	N	430	93	77	340	303	259	216	173	130	86	43	
	10000	2400	27.4	N	400	90	77	354	315	270	225	180	135	90	45	
	8000	2300	27.1	N	371	89	79	377	336	288	240	192	144	96	48	
	6000	2200	27.4	N	329	85	78	406	362	310	258	206	155	103	52	
	4000	2200	28.6	N	340	88	83	407	362	311	259	207	155	104	52	
	2000	2200	29.0	N	329	86	83	410	366	314	261	209	157	104	52	
	SL	2200	30.1	N	347	91	91	412	367	315	262	210	157	105	52	
9,000	14000	2400	24.3	N	341	94	76	433	386	331	276	221	165	110	55	
	12000	2400	24.0	N	335	96	80	451	401	344	287	229	172	115	57	
	10000	2300	24.0	N	319	94	81	463	413	354	295	236	177	117	59	
	8000	2200	26.0	N	312	94	83	474	422	362	301	241	181	121	60	
	6000	2200	26.5	N	305	94	86	485	431	370	308	247	185	123	62	
	4000	2200	27.3	N	318	97	91	479	427	366	305	244	183	122	61	
	2000	2200	28.5	N	321	94	91	460	410	351	293	234	176	117	59	
	SL	2200	29.4	N	325	94	94	455	405	347	289	231	173	116	58	

TABLE 2-VI (Cont)

STANDARD DAY **CRUISE CONDITION–INTERMEDIATE**

MODELS: CH-34A & CH-34C
DATE: AUGUST 1958
DATA BASIS: FLIGHT TEST

ENGINE: R-1820-84A
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

GROSS WEIGHT	PRESS. ALT	POWER SETTINGS			APPROXIMATE			RANGE – NAUTICAL MILES								
		ENGINE SPEED	MAN PRESS.	MIX-TURE	TOTAL	SPEED/KNOTS		1572 LB FUEL	1400 LB FUEL	1200 LB FUEL	1000 LB FUEL	800 LB FUEL	600 LB FUEL	400 LB FUEL	200 LB FUEL	LB FUEL
POUNDS	FEET	RPM	IN. HG		LB/HR	TAS	CAS									
13,500	12000															
	10000															
	8000															
	6000															
	4000	2500	35.2	N	635	94	89	233	207	178	148	118	88	59	29	
	2000	2500	37.5	N	690	101	98	230	205	176	146	117	88	59	29	
	SL	2500	39.4	N	700	104	104	234	208	178	149	119	89	59	30	
12,000	12000															
	10000															
	8000	2500	30.5	N	510	92	82	283	253	216	180	144	109	72	36	
	6000	2500	32.0	N	550	99	91	283	252	216	180	144	108	72	36	
	4000	2500	34.5	N	605	105	99	273	243	208	173	139	104	69	35	
	2000	2400	37.0	N	640	108	105	266	237	203	168	135	102	68	33	
	SL	2400	37.0	N	630	107	107	268	238	203	170	136	102	67	34	
10,500	12000	2500	27.5	N	435	94	78	339	303	259	216	173	130	86	43	
	10000	2500	29.0	N	473	101	87	335	299	257	213	171	128	86	42	
	8000	2500	30.5	N	500	106	94	333	297	254	212	170	127	85	42	
	6000	2400	32.5	N	541	109	100	317	282	242	202	161	121	81	40	
	4000	2400	33.5	N	550	110	104	315	281	240	200	160	120	80	40	
	2000	2400	35.7	N	595	112	109	296	263	226	188	160	113	75	38	
	SL	2300	36.0	N	547	110	110	316	282	241	201	161	121	80	41	
9,000	14000	2500	25.3	N	395	105	85	418	372	319	266	213	160	106	54	
	12000	2500	27.1	N	427	110	92	405	361	309	257	206	155	99	52	
	10000	2400	29.0	N	465	112	95	379	337	289	241	193	144	96	48	
	8000	2400	30.4	N	480	114	101	374	333	285	237	189	143	95	48	
	6000	2400	31.9	N	522	115	105	346	308	265	221	176	132	89	44	
	4000	2400	33.2	N	535	115	108	338	301	258	215	173	129	86	43	
	2000	2300	34.6	N	531	114	111	337	301	258	214	172	129	86	43	
	SL	2300	34.8	N	525	112	112	335	299	256	213	170	128	85	43	

TABLE 2-VI (Cont)

STANDARD DAY — **CRUISE CONDITION – METO POWER**

MODELS: CH-34A & CH-34C
DATE: AUGUST 1958
DATA BASIS: FLIGHT TEST

ENGINE: R-1820-84A
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

GROSS WEIGHT POUNDS	PRESS. ALT FEET	POWER SETTINGS: ENGINE SPEED RPM	MAN PRESS. IN. HG	MIX-TURE	APPROXIMATE TOTAL LB/HR	SPEED/KNOTS TAS	SPEED/KNOTS CAS	RANGE – NAUTICAL MILES: 1572 LB FUEL	1400 LB FUEL	1200 LB FUEL	1000 LB FUEL	800 LB FUEL	600 LB FUEL	400 LB FUEL	200 LB FUEL	LB FUEL
	12000															
	10000															
	8000	2500	32.2	N	565	63	56	175	156	134	112	89	67	45	22	
13,500	6000	2500	32.8	N	578	83	76	226	201	172	144	115	86	57	29	
	4000	2500	36.2	N	685	97	91	223	198	170	142	113	85	57	28	
	2000	2500	41.0	N	807	108	105	210	187	161	134	107	80	54	27	
	SL	2500	44.0	N	875	113	113	203	181	155	129	103	78	52	26	
	12000	2500	29.0	N	503	54	45	169	150	129	108	86	64	43	22	
	10000	2500	29.0	N	480	79	68	259	231	198	165	132	99	66	33	
	8000	2500	31.0	N	537	95	84	278	247	212	177	141	106	71	35	
12,000	6000	2500	35.4	N	660	106	97	253	225	193	161	129	96	64	32	
	4000	2500	39.4	N	800	115	108	226	201	173	144	115	86	58	29	
	2000	2500	45.0	N	932	122	108	206	183	157	131	105	78	52	26	
	SL	2500	47.5	N	975	124	124	200	179	152	127	101	76	51	25	
	12000	2500	27.3	N	435	93	77	336	299	257	214	171	128	86	43	
	10000	2500	30.1	N	512	105	90	322	287	246	205	164	123	82	41	
	8000	2500	34.5	N	650	115	102	278	248	212	177	142	106	71	35	
10,500	6000	2500	40.0	N	815	123	113	237	211	181	151	121	91	60	30	
	4000	2500	44.8	N	938	129	122	216	193	165	137	110	83	55	28	
	2000	2500	46.6	N	970	129	125	209	186	160	133	106	80	53	27	
	SL	2500	47.5	N	975	129	129	202	185	159	132	106	79	53	26	
	14000	2500	27.2	N	450	109	88	380	339	291	242	194	145	97	48	
	12000	2500	29.8	N	532	118	98	348	310	267	222	177	133	89	45	
	10000	2500	34.3	N	655	124	107	298	265	228	189	152	114	76	38	
9,000	8000	2500	38.6	N	792	130	115	258	230	197	164	131	98	66	33	
	6000	2500	41.5	N	874	133	122	239	213	183	152	122	91	60	30	
	4000	2500	44.8	N	938	136	128	228	203	174	145	116	87	58	29	
	2000	2500	46.6	N	970	134	130	217	193	165	138	110	82	55	28	
	SL	2500	47.5	N	975	132	132	213	190	162	135	108	81	54	27	

TABLE 2-VII

MAXIMUM ENDURANCE

STANDARD DAY

MODELS: CH-34A & CH-34C
DATE: AUGUST 1958
DATA BASIS: FLIGHT TEST

ENGINE: R-1820-84A
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

GROSS WEIGHT	PRESS. ALT	POWER SETTINGS			APPROXIMATE			ENDURANCE – HOURS								
		ENGINE SPEED	MAN PRESS.	MIX-TURE	TOTAL	SPEED/KNOTS		1572 LB FUEL	1400 LB FUEL	1200 LB FUEL	1000 LB FUEL	800 LB FUEL	600 LB FUEL	400 LB FUEL	200 LB FUEL	LB FUEL
POUNDS	FEET	RPM	IN. HG		LB/HR	TAS	CAS									
	12000															
	10000															
	8000															
13,500	6000	2400	32.3	N	509	62	57	3.09	2.75	2.36	1.96	1.57	1.18	.78	.39	
	4000	2300	32.1	N	460	60	56	3.42	3.04	2.61	2.17	1.74	1.30	.87	.43	
	2000	2300	31.7	N	429	64	62	3.66	3.26	2.80	2.33	1.86	1.40	.93	.47	
	SL	2200	29.8	N	398	62	62	3.95	3.52	3.02	2.51	2.01	1.51	1.00	.50	
	12000															
	10000	2500	27.5	N	435	65	56	3.61	3.22	2.76	2.30	1.84	1.38	.92	.46	
	8000	2300	29.1	N	395	55	49	3.98	3.54	3.04	2.53	2.02	1.52	1.01	.51	
12,000	6000	2300	28.0	N	364	65	59	4.31	3.85	3.30	2.74	2.19	1.64	1.10	.55	
	4000	2200	28.9	N	342	63	59	4.60	4.09	3.51	2.92	2.34	1.75	1.17	.58	
	2000	2200	28.5	N	330	64	62	4.76	4.24	3.64	3.03	2.42	1.82	1.21	.61	
	SL	2200	29.1	N	328	62	62	4.79	4.27	3.66	3.05	2.44	1.82	1.22	.61	
	12000	2300	25.2	N	315	58	48	4.99	4.44	3.81	3.17	2.54	1.90	1.27	.63	
	10000	2300	25.4	N	312	63	54	5.04	4.49	3.85	3.21	2.57	1.93	1.28	.64	
	8000	2200	25.2	N	298	62	55	5.28	4.70	4.03	3.36	2.69	2.02	1.34	.67	
10,500	6000	2200	25.0	N	293	61	56	5.37	4.78	4.10	3.41	2.73	2.05	1.36	.68	
	4000	2200	25.8	N	292	60	56	5.39	4.79	4.11	3.42	2.74	2.06	1.37	.68	
	2000	2200	26.2	N	287	60	58	5.47	4.88	4.18	3.48	2.78	2.09	1.39	.70	
	SL	2200	26.3	N	288	59	59	5.47	4.86	4.17	3.47	2.78	2.08	1.39	.69	
	14000	2200	21.5	N	280	61	49	5.61	5.00	4.29	3.57	2.86	2.14	1.43	.71	
	12000	2200	21.4	N	277	64	53	5.68	5.05	4.33	3.61	2.89	2.17	1.44	.72	
	10000	2200	21.8	N	275	62	53	5.72	5.09	4.36	3.64	2.91	2.18	1.46	.73	
9,000	8000	2200	22.1	N	275	61	54	5.72	5.09	4.36	3.64	2.91	2.18	1.46	.73	
	6000	2200	22.6	N	275	61	56	5.72	5.09	4.36	3.64	2.91	2.18	1.46	.73	
	4000	2200	23.5	N	274	59	56	5.74	5.11	4.38	3.65	2.92	2.19	1.46	.73	
	2000	2200	29.1	N	274	55	53	5.74	5.11	4.38	3.65	2.92	2.19	1.46	.73	
	SL	2200	24.8	N	274	54	54	5.74	5.11	4.38	3.65	2.92	2.19	1.46	.73	

TABLE 2-VIII
HOVERING ENDURANCE
STANDARD DAY

MODELS: CH-34A & CH-34C
DATE: AUGUST 1958
DATA BASIS: FLIGHT TEST

ENGINE: R-1820-84A
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

GROSS WEIGHT	PRESS. ALT	ENGINE SPEED	MAN PRESS.	MIX-TURE	APPROXIMATE TOTAL	SPEED/KNOTS		ENDURANCE – HOURS 1572 LB FUEL	1400 LB FUEL	1200 LB FUEL	1000 LB FUEL	800 LB FUEL	600 LB FUEL	400 LB FUEL	200 LB FUEL	LB FUEL
POUNDS	FEET	RPM	IN. HG		LB/HR	TAS	CAS									
13,500	12000															
	10000															
	8000	2500	38.5	N	795	35	31	1.98	1.76	1.51	1.26	1.01	.75	.50	.25	
	6000	2500	41.5	N	875	28	26	1.80	1.60	1.37	1.14	.91	.69	.46	.23	
	4000	2500	44.8	N	938	21	20	1.68	1.49	1.28	1.07	.85	.64	.43	.21	
	2000	2500	46.2	N	970	16	16	1.62	1.44	1.24	1.03	.82	.62	.41	.21	
	SL	2500	47.5	N	975	15	15	1.61	1.44	1.23	1.03	.82	.62	.41	.21	
12,000	12000	2500	33.3	N	700	36	30	2.25	2.0	1.71	1.43	1.14	.86	.57	.29	
	10000	2500	35.7	N	725	29	25	2.17	1.93	1.66	1.38	1.10	.83	.55	.28	
	8000	2500	38.5	N	792	22	20	1.99	1.77	1.52	1.26	1.01	.76	.51	.25	
	6000	2500	41.5	N	875	15	14	1.80	1.60	1.37	1.14	.91	.69	.46	.23	
	4000	2500	44.8	N	935	0	0	1.68	1.50	1.28	1.07	.86	.64	.43	.21	
	2000	2500	44.2	N	908	0	0	1.73	1.54	1.32	1.10	.88	.66	.44	.22	
	SL	2500	44.7	N	892	0	0	1.76	1.57	1.35	1.12	.90	.67	.45	.23	
10,500	12000	2500	33.3	N	700	23	19	2.25	2.0	1.71	1.43	1.14	.86	.57	.29	
	10000	2500	35.7	N	725	13	11	2.17	1.93	1.66	1.38	1.10	.83	.55	.28	
	8000	2500	38.0	N	775	0	0	2.03	1.81	1.55	1.29	1.03	.77	.52	.26	
	6000	2400	37.2	N	725	0	0	2.17	1.93	1.66	1.38	1.10	.83	.55	.28	
	4000	2400	37.7	N	705	0	0	2.23	1.99	1.70	1.42	1.14	.85	.57	.28	
	2000	2300	37.8	N	652	0	0	2.41	2.15	1.84	1.53	1.23	.92	.61	.31	
	SL	2300	38.0	N	635	0	0	2.48	2.21	1.89	1.58	1.26	.95	.63	.32	
9,000	14000	2500	30.8	N	575	9	7	2.73	2.44	2.09	1.74	1.39	1.04	.70	.35	
	12000	2400	31.5	N	575	0	0	2.73	2.44	2.09	1.74	1.39	1.04	.70	.35	
	10000	2300	32.0	N	530	0	0	2.97	2.64	2.26	1.89	1.51	1.13	.76	.38	
	8000	2300	32.1	N	520	0	0	3.02	2.69	2.31	1.92	1.54	1.15	.77	.39	
	6000	2300	32.4	N	495	0	0	3.18	2.83	2.42	2.02	1.62	1.21	.81	.40	
	4000	2300	32.5	N	492	0	0	3.20	2.85	2.44	2.03	1.63	1.22	.81	.41	
	2000	2300	33.2	N	485	0	0	3.24	2.89	2.47	2.06	1.65	1.24	.83	.41	
	SL	2300	33.2	N	475	0	0	3.31	2.95	2.53	2.11	1.68	1.26	.84	.42	

NOTE: MINIMUM HOVERING RPM

TABLE 2-IX
LANDING DISTANCE – FEET
POWER – OFF

MODELS: CH-34A & CH-34C
DATE: JUNE 1959
DATA BASIS: FLIGHT TEST

POWER – OFF
FIRM DRY SOD
CONFIGURATION: CLEAN

ENGINE: R-1820-84A
FUEL GRADE: 115/145
FUEL DENSITY: 6.0 LB/GAL

GROSS WEIGHT LB	PRESSURE ALTITUDE	BEST CAS APPROACH KNOTS	-25°C		-5°C		+15°C		+35°C		+55°C	
			GROUND ROLL	CLEAR 50 FT	GROUND ROLL	CLEAR 50 FT	GROUND ROLL	CLEAR 50 FT	GROUND ROLL	CLEAR 50 FT	GROUND ROLL	CLEAR 50 FT
13,500	SL	46	115	465	130	495	140	520	155	550	170	585
	2000	46	130	490	145	530	160	555	175	585	190	625
	4000	46	145	525	160	565	175	590	190	630	210	675
	6000	46	160	555	180	600	195	635	215	680	235	730
	8000	46	180	600	200	645	215	685	240	735	260	790
	10000	46	200	645	220	695	240	745	265	800	295	855
	12000	46	225	700	245	755	270	815	300	880	335	965
12,000	SL	46	105	455	115	480	130	505	140	530	155	570
	2000	46	115	480	130	510	145	540	155	565	170	610
	4000	46	130	515	145	545	160	575	170	610	190	650
	6000	46	145	545	160	580	175	620	190	655	210	705
	8000	46	160	585	180	625	195	665	215	705	240	765
	10000	46	180	605	200	670	220	725	240	770	270	835
	12000	46	200	680	225	730	245	790	270	855	300	930
10,500	SL	46	95	440	105	470	110	490	125	515	135	550
	2000	46	105	470	115	495	125	520	140	550	150	585
	4000	46	115	495	125	530	140	555	155	585	165	630
	6000	46	125	530	140	560	155	595	170	630	190	680
	8000	46	140	565	160	600	170	640	190	685	215	740
	10000	46	160	605	180	650	190	695	210	745	235	805
	12000	46	180	655	200	705	215	760	240	821	265	890
9,000	SL	46	80	430	90	455	100	475	110	505	120	535
	2000	46	90	455	100	480	110	505	120	540	130	570
	4000	46	100	480	110	510	120	540	135	575	145	610
	6000	46	110	505	120	540	135	575	150	615	165	655
	8000	46	125	540	135	585	150	620	165	665	180	710
	10000	46	140	585	155	625	165	670	185	735	205	775
	12000	46	155	630	175	680	190	735	210	790	230	850

NOTE: POWER ON LANDING DISTANCES WILL BE APPROXIMATELY 10 TO 15 PERCENT LESS THAN THE DISTANCES STATED ABOVE. AT GROSS WEIGHT, TEMPERATURE, AND ALTITUDE CONDITIONS WHERE HOVERING OUT OF GROUND EFFECT IS POSSIBLE, VERTICAL DESCENTS CAN BE MADE. FOR THESE CONDITIONS SEE CHART 2–IV.

TM 55-1520-202-10CL
TAKEOFF AND LANDING DATA CARD
TAKEOFF DATA

NORMAL & MAXIMUM PERFORMANCE TAKEOFF:

MAX GROSS WT ______________ LB.
INDICATED AIRSPEED______________ KN.
ACCEL DISTANCE ______________ FT.
CLEAR 50-FOOT ______________ FT.

ROLLING TAKEOFF:

MAX GROSS WT ______________ LB.
INDICATED AIRSPEED______________ KN.
ACCEL DISTANCE ______________ FT.
CLEAR 50-FOOT ______________ FT.

VERTICAL TAKEOFF:

MAX GROSS WT ______________ LB.
MAX RATE OF CLIMB ______________ FPM.

LANDING

APPROACH TO HOVER & VERTICAL LANDING:

APPROACH IAS ______________ KN.
HOVER ALTITUDE ______________ FT.

ROLLING LANDING:

APPROACH IAS ______________ KN.
DECELERATE ALT ______________ FT.
MAX GROUND SPEED ______________ KN.

(FRONT SIDE)

TM 55-1520-202-10CL
CONDITIONS

PRESSURE ALTITUDE________FEET
TEMPERATURE______ C DEWPOINT______C
WIND________KNOTS________
RUNWAY LENGTH ________FEET HEADING______
DENSITY ALTITUDE ________FEET
TAKEOFF MANF PRESS.____IN. HG AT ______ RPM
CLIMB METO POWER:
MANIFOLD PRESSURE______IN. HG AT ______ RPM
RECOMMENDED METO:
MANIFOLD PRESSURE ______ IN. HG AT______ RPM
CRUISE POWER:
MANIFOLD PRESSURE______IN. HG AT ______ RPM
FUEL IN HOURS________HOURS.
MISSION LENGTH________HOURS.
GROSS WEIGHT (TAKEOFF)__________LB
GROSS WEIGHT (LANDING)________LB.
TAKEOFF CG AT STATION ________ (130.7-146.7)
LANDING CG AT STATION ________ (130.7-146.7)
REMARKS:

(REAR SIDE)

Figure 2–1. Takeoff and Landing Data Card

Conditions contained on the rear side of the data card, such as temperature, dewpoint, wind, etc, can be obtained from briefing or tower operator.

2–41. COMBINED USE OF THE TABLES AND CHARTS.

2–42. To explain the use of the tables and charts, the following example problem is provided.

2–43. EXAMPLE PROBLEM.

2–44. It is necessary to transport a load of 2000 pounds to a certain location 75 nautical miles from the base, drop it there, and return to the base. Due to terrain clearances, both legs of the flight must be accomplished at 2000 feet. At the drop point a descent will be made to sea level and, after hovering, a climb will be made to 2000 feet. Fifteen minutes hovering will be allowed to maneuver into position for dropping the load. Temperature is 15°C (59°F). In addition to the pilot, the crew consists of a copilot and one crewmember.

2–45. TAKEOFF GROSS WEIGHT.

Operating weight from weight limitations chart

(chart 2–II, Chapter 7) =	8017 lb
Added crew (two) =	400 lb
Load on cargo sling =	2000 lb
Usable fuel (262 gal) =	1572 lb
Takeoff gross weight	= 11,989 lb

2–46. WARMUP, TAKEOFF, AND CLIMB. Fuel used for warmup, takeoff, and climb from sea level to 2000 feet with a gross weight of 11,989 lb from 12,000 lb 15°C (59°F) column, climb table for METO power (table 2–V). 106 lb

2–47. OUTWARD LEG.
Gross weight = 11,989 - 106 = 11,883 lb.

Fuel used at intermediate cruise, 2000 feet altitude for 75 nautical miles. From range table intermediate cruise for 12,000 lb (table 2–VI, sheet 2) = 75 nautical miles/108 TAS X 640 lb/hr = 445 lb

2–48. LETDOWN. Letdown assumed to be with zero distance covered and no fuel consumed.

2–49. HOVERING. Gross weight for hovering = 11,883 - 445 = 11,438 lb. Fuel consumed in hovering to discharge cargo at sea level for 15 minutes from 12,000 lb hovering endurance table (table 2–VIII) = 892 lb/hr X 1/4 hr = 223 lb

Gross weight after dropping load 11,438 - 233 - 2000 = 9205 lb

2–50. RETURN TRIP. Total fuel remaining for return trip = 1572 - 106 - 445 - 223 = 798 lb

2–51. CLIMB. Fuel used to climb to 2000 feet from 9000 lb climb table (table 2–V) = 96 - 82 as no warmup or takeoff allowance is necessary.

2–52. Gross weight = 9205 - 14 = 9191 lb. Fuel used at medium cruise, 2000 feet altitude for cruising 75 nautical miles, from range table – intermediate cruise for 9000 lb (table 2–VI, sheet 2) = 75 nautical miles/114 TAS X 531 lb/hr = 350 lb

2–53. RESERVE FUEL. 798 -14 -350 = 434 lb (72.3 gal) or 49 minutes at intermediate cruise.

INDEX

APPENDIX I
REFERENCES

AR 310-1	Military Publications (General Policies)
AR 310-3	Military Publications (Preparation and Processing)
AR 320-5	Dictionary of United States Army Terms
AR 320-50	Authorized Abbreviations and Brevity Codes
DA PAM 108-1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings.
DA PAM 310-1	Index of Administrative Publications
DA PAM 310-2	Index of Blank Forms
DA PAM 310-4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders
FM 21-5	Military Training
FM 21-6	Techniques of Military Instructions
SM 55-1 Series	Supply Manuals (Stock List Type)
TM 1-215	Attitude Instrument Flying
TM 1-225	Navigation for Army Aviation
TM 1-260	Principles of Rotary Wing Flight
TM 3-220	Chemical, Biological, and Radiological (CBR) Decontamination
TM 5-200	Camouflage Nets and Net Sets
TM 38-750	The Army Equipment Record System and Procedures
TM 55-405-1	Army Maintenance Engineering Manual, General Practices
TM 55-405-9	Army Maintenance Engineering Manual, Weight and Balance

APPENDIX II
MAINTENANCE ALLOCATION CHART

The Maintenance Allocation Chart will be found only in Part II of the Technical Manual.

APPENDIX III
BASIC ISSUE ITEM LIST

For basic issue items, refer to DA Form 2408-17 Aircraft Inventory Record.

APPENDIX IV
OPERATOR'S CHECKLIST

The operator's condensed checklist is printed separately from Part I of the Technical Manual and is designated TM 55-1520-202-10CL.